5.7

BIOLOGICAL ASSESSMENT ADDENDUM

MCCORMICK AND BAXTER CREOSOTING COMPANY PORTLAND, OREGON SEDIMENT CAP

FINAL

State of Oregon
Department of Environmental Quality

October 2003

U.S. ENVIRONMENTAL PROTECTION AGENCY
OREGON STATE DEPARTMENT OF ENVIRONMENTAL QUALITY

DOCUMENT PURPOSE

This document is the Environmental Protection Agency's (EPA) evaluation of potential effects from a proposed Federal action on plant and animal species covered under the Endangered Species Act (ESA). EPA intends this document to demonstrate substantive compliance with ESA pursuant to the requirements of the National Contingency Plan (NCP) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The Federal action addressed in this document is the capping of contaminated sediment in the Willamette River at the Federal Superfund site known as the McCormick and Baxter Creosoting Company, Portland, Oregon. This action is one of several remedial actions being taken under CERCLA to significantly reduce the potential risk to human health and/or ecological receptors resulting from potential exposure to contaminants present in sediment, groundwater, and soils at the project area.

EPA has designated the Oregon Department of Environmental Quality (DEQ) as the lead in implementing the actions contained within the CERCLA Record of Decision (ROD) for the site, although these remain Federal actions with Federal funding. DEQ, however, will be solely responsible for the long-term operation and maintenance of the remedies.

EPA previously submitted a biological assessment for the construction of a barrier wall (Biological Assessment, McCormick and Baxter Creosoting Company, Portland, Oregon - June 2002). This evaluation is an addendum to the June 2002 Biological Assessment to avoid repeating the background information presented there. EPA considers this a living document in that technical studies are on-going and additional studies my be conducted prior to construction of the sediment cap. Furthermore, certain design implementation details will not be known until a selected contractor has had the opportunity to consider construction techniques. However, DEQ (on behalf of EPA) will set contractor performance standards based on the findings of this document as well as other supporting documents contained in the administrative record. Upon receipt of specific construction details or in the event that changes to the design are made based on on-going or future technical studies, EPA and DEQ will forward those details to the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS) for their review.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. SUMMARY OF FINDINGS

Remedial actions described in the Environmental Protection Agency's 1996 Record of Decision (ROD), issued in conjunction with the Oregon State Department of Environmental Quality (DEQ) for the McCormick and Baxter Creosoting Company, are being taken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These actions also are considered agency actions under the Endangered Species Act (ESA) and are therefore required to substantively comply with the ESA. The U.S. Environmental Protection Agency (EPA) determined that this biological assessment addendum is necessary to evaluate potential effects of the proposed remedial activities on federally listed threatened and endangered species.

This biological assessment (BA) addendum evaluates the potential effects on threatened and endangered species from the following activities that comprise the proposed action:

- removal of in-water structures in the Willamette River that could potentially interfere with the integrity of the sediment cap;
- excavation and grading of the existing bank;
- removal of an existing bulkhead and dock remnant on the existing shoreline;
- construction of a sediment cap in the Willamette River;
- planting riparian vegetation on the completed shoreline; and
- conservation measures on-site and at Willamette Cove, which include piling and debris removal and sediment trapping measures.

The federally listed species are:

- Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*)
- Upper Willamette River Chinook Salmon (*Oncorhynchus tshawytscha)*
- Lower Columbia River Steelhead *(Oncorhynchus mykiss)*
- Upper Willamette River Steelhead (*Oncorhynchus mykiss)*
- Columbia River Chum Salmon (*Oncorhynchus keta*)
- Bald Eagle (Haliaeetus leucocephalus)
- Golden Paintbrush (*Castilleja levisecta*)

- Water Howellia (Howellia aquatilis)
- Bradshaw's lomatium (*Lomatium bradshawii*)
- Nelson's checker-mallow (*Sidalcea nelsoniana*)
- Willamette daisy (Erigeron decumbens var. decumbens)
- Kincaid's lupine (Lupinus sulphureus var. kincaidii)

The Federal candidate species are:

- Lower Columbia River/Southwest Washington Coho Salmon (*Oncorhynchus kisutch)*
- Oregon spotted frog (*Rana pretiosa*).

EPA believes that the long-term benefits of the remedial actions (a cleaner and more productive environment) will aid in the recovery of federally listed threatened and endangered species. However, EPA acknowledges that the remedial actions would result in the loss of aquatic habitat at the project site. Therefore, EPA determined the following effects for each species.

Listed Species

- Lower Columbia River Chinook Salmon - May affect, likely to adversely affect
- Upper Willamette River Chinook Salmon – May affect, likely to adversely affect
- Lower Columbia River Steelhead – May affect, likely to adversely affect
- Upper Willamette River Chinook Salmon – May affect, likely to adversely affect
- Columbia River Chum Salmon – May affect, likely to adversely affect
- Bald Eagle - May affect, not likely to adversely affect
- Golden Paintbrush – No effect
- Water Howellia – No effect
- Bradshaw's lomatium – No effect
- Nelson's checker-mallow – No effect

- Willamette daisy – No effect
- Kincaid's lupine – No effect

Candidate Species

- Lower Columbia River/Southwest Washington Coho Salmon – Will not result in jeopardy
- Oregon Spotted Frog – Will not result in jeopardy

Petitioned Candidate Species

Three species of lamprey that are native to the Willamette River (Pacific lamprey, river lamprey and western brook lamprey) were named in a 2003 petition to the US Fish and Wildlife Service as candidates for listing as threatened or endangered under the ESA. Given that these species are not yet formally listed, they are not included in this Biological Assessment Addendum, which is limited in scope to federally listed species. In recognition of the cultural importance of lamprey to Northwest Tribes and the pending listing of lamprey under the ESA, EPA and ODEQ have elected to include information about Pacific lamprey as an appendix to this BA addendum. However, at this time these species proposed for listing are not included in the evaluation of potential impacts on listed species. When listing occurs, such listed species will be included in future Biological Assessments.

EPA has included a description of conservation measures that would be used to minimize effects to the species of concern during construction (see Section 18). In addition, EPA will continue consulting with National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS) during design to ensure that appropriate actions are taken to address ESA concerns.

2. DESCRIPTION OF THE PROPOSED ACTION

The proposed action addressed in this BA addendum is the construction of the sediment cap in the Willamette River. This action includes the activities listed in Section 1, above; these activities are discussed in the paragraphs below. Figure 1 is a site location map. Figure 2 provides the existing site layout.

2.1 REMOVAL OF IN-WATER STRUCTURES IN THE WILLAMETTE RIVER

The removal of pilings and dolphins will occur over a range of elevations from about 9 to 0[1] Columbia River Datum (CRD), –4 to –6 CRD in the vicinity of the Willamette Cove, and from –10 to –30 CRD extending from the railroad bridge upstream, paralleling the harbor line (Figure 3). Ordinary high water for CRD is 14.86 with 0.0 as ordinary low water. Approximately 775 pilings, including those associated with the dolphins, would be demolished. The area where pilings would be removed covers approximately 27,600 square feet (0.6 acre).

The wood pilings would be removed at the sediment surface by snipping at the mudline and would be transported to an off-site disposal facility.

2.2 REMOVAL OF EXISTING BULKHEAD AND DOCK REMNANT

The shoreline supports a small remnant of a former creosote dock. About 180 feet of wooden bulkhead is associated with the dock remnant and runs roughly perpendicular to the shoreline (Figure 3). These are the remaining "hard features" along the existing shoreline, excluding those outside of the construction site at Willamette Cove. The dock and bulkhead structures would be removed to facilitate grading the bank to a more stable and natural slope. The waste wood would be disposed at a suitable disposal facility. Approximately 5,750 square feet of dock support and 900 square feet of bulkhead would be removed. Removal of the structures would occur before sediment capping to provide the final bank configuration against which the sediment cap will abut.

---

[1]All elevations are in feet.

2.3 EXCAVATION AND GRADING OF THE EXISTING BANK

The McCormick and Baxter site was largely created through the historic and repeated placement of dredged materials in wetlands and shallow water areas along the banks of the Willamette. The resulting shoreline has eroded to a steep embankment. In its existing state, the embankment would present maintenance problems for the shoreward edge of the proposed sediment cap, if the embankment should fail, and future upland soil cap work at the bank edge would have additional negative impacts on the sediment cap.

To ensure stability, EPA proposes to grade the bank upslope from the area of the sediment cap to a maximum slope of 4 feet horizontal to 1 foot vertical (4:1 slope). The slope will incorporate a terrace and would vary in slope from 4:1 to 7:1 to support a varied riparian community (see Section 2.5). Figures 4 and 5 show the plans and profiles of the existing and proposed shorelines.

The terrace would vary in width from 12 to 18 feet and in elevation from 17.7 to 19.7 NGVD (National Geodetic Vertical Datum). The terrace would provide storage for river flows above the approximate 5-year flood event. The purpose of the terrace is to provide additional floodway to compensate for the sediment cap fill in the river. The terrace (as well as the bank slope) would be planted with riparian vegetation. This will serve as a buffer for storm water from the upland site as well as providing habitat for fish and wildlife. This concept is consistent with the City of Portland's Willamette Greenway Plan.

After the bank has been graded, 1.5 feet of clean soil fill and 6 inches of topsoil would be placed to support the riparian plantings. The soil layers would be covered by a turf reinforcement mat (TRM). The TRM is a permanent structure; it does not photo-degrade, and its purpose is to augment the strength of a vegetative root mass. It is considered a "soft" option erosion control as opposed to riprap or other "hard" alternatives. TRM is a relatively new product that has been used successfully in areas typically reinforced by riprap. TRM application recommendations include methods to accommodate larger plants such as shrubs and trees.

2.4 SEDIMENT CAP IN THE WILLAMETTE RIVER

The Record of Decision (ROD) for the McCormick & Baxter site identified capping as the selected remedy for sediment contamination at the site, with the objective of preventing humans and benthic organisms from directly contacting the contaminated sediment. A second objective was to minimize the release of chemicals from sediments that might contaminate the Willamette River in excess of Federal and State ambient water quality criteria. EPA determined that this would be accomplished through placement of a 2-foot layer of sand, or other readily available clean fill, in addition to some form of armoring to protect project integrity.

The cap would cover approximately 25 acres of area below ordinary high water (OHW). It would extend along the shoreline within most of the length of the embayment, along the area of the former creosote dock, under the railroad bridge, and just downstream into Willamette Cove to the north (Figure 6). The proposed cap boundary also includes areas of known NAPL migration (seeps). The seeps would be covered with special material, organophyllic clay that has an affinity to absorb these types of contaminants.

Approximately 13.5 acres within the cap would be armored with articulated concrete block (ACB) from a depth of –7 CRD (finished elevation) to approximately OHW (Figure 6). (A refinement in the cap design may allow for 6.7 acres of 10-inch minus rock to substitute for ACB, thereby reducing the area of ACB to 6.8 acres.) Approximately 11.5 acres of cap would be armored with 6-inch minus rock (a gradation of material from 6-inch diameter size to gravel). The 6-inch minus material will extend from the –7 CRD finished elevation to as deep as –50 CRD.

The sediment cap would transition to an upland soil cap at the bank near the shoreline. The sediment cap will extend into the river to the base of the steeply sloped area at approximately the 40-foot depth line and will terminate at least 100 feet from the eastern edge of the Federal navigation channel.

EPA estimates that approximately 8 acres of area now currently at -2 CRD to +3 (and therefore mostly submerged under normal conditions) will elevate to between 0 and +5 CRD following cap installation. This will likely result in these areas being submerged less often than current conditions.

2.5 Riparian Planting on the Completed Shoreline

EPA proposes to excavate and grade the existing bank to create a stable and more naturally appearing shoreline and riparian habitat. This would occur along the 2,200 linear feet of the project's shoreline and would be 132 feet in width. The existing bank covers approximately 2.5 acres in area. The resulting banking would cover approximately

5.5 acres (see Figure 4 and 5). Included in this effort would be soil preparation and enhancements to support a diverse riparian community.

The part of the project (currently between 14.6 to 30.0 NGVD) is in the periodic floodplain of the Willamette River. Elevation of the 2-year event is 14.5 NGVD, the 10-year event is 18.7 NGVD and the 100-year event is 26.4 NGVD. Ordinary low water is 1.7 NGVD and ordinary high water (OHW) is 16.6 NGVD.[2] The existing width of the area is approximately 60 to 70 feet. There is minimal connectivity to a small riparian community on the northern boundary, located on top of the steep shoreline grade. There is no riparian vegetation below OHW or within the regularly occurring flood zones, which results in minimal aquatic habitat support.

The plants on the existing shoreline are between elevations 15 and 30 NGVD. The species at the site are typical of a compromised riparian community consisting of Scot's broom (*Cytisus scoparius*), invasive grasses, cottonwood (*Populus balsamifera*), clematis (*Clematis vitalba*), and Himalayan blackberry (*Rubus discolor*). The area lacks complexity and diversity in the understory, and lacks canopy. The area does not have the edge or height diversity typically found in a native plant community. Minimal height diversity exists in the invasive weeds on the project area. Edge habitat to the east, south and north contains species of low habitat value (invasive grasses, Himalayan blackberry and Scot's broom).

The area would be planted with a diverse mix of native trees, shrubs and grasses to mimic an early successional gallery forest. Cottonwood, willows, native shrubs, forbs, and grasses would characterize the forest.

Complete details of the proposed riparian planting is contained in the Vegetation Management Strategy for McCormick and Baxter (Appendix A).

---

[2]EPA is using two elevation datum for the sediment capping project. In-water work descriptions are based on Columbia River Datum (CRD) because this is consistent with the Corps navigation channel in the Willamette River upon which the site bathymetry is based. For upland work descriptions, EPA adhered to the NGVD datum for consistency with upland datum. The elevation of 0.0 CRD is equivalent to 1.74 NGVD.

2.6 CONSERVATION MEASURES ON-SITE AND AT WILLAMETTE COVE

The intent of the actions proposed below is to protect, expand, and enhance the existing shallow-water, low energy environment. In addition to creating the riparian buffer along the shoreline of the McCormick & Baxter property, EPA proposes the following actions:

- ***Removal of existing structures***. There are approximately 350 remnant pilings from a creosoted treated dock at the upstream end of the McCormick & Baxter site, adjacent to the Triangle property (Figures 7 and 8). Since these pilings are not in areas of creosote-contaminated sediment, EPA proposes to remove these pilings by pulling them out rather than snipping at the mud line as is planned for pilings within the cap footprint. The benefit would come from removing treated wood from the aquatic environment and by reducing predator habitat. This action would be in addition to the removal of the in-water structures that need to be removed for cap construction.

- ***Protection of the nearshore environment***. There may be a disadvantage to removing the structures noted above in that they likely serve to dissipate wave and current energy. Removing the structure may diminish the functions of the existing 'cove-like' environment. However, EPA proposes to a place rock mound consisting of appropriate diameter rocks along the edge of the shallow embayment roughly in the same position as the existing dolphins and pilings. The purpose of this rock mound is to help dissipate wave energy and trap sand, much the same way as the existing pilings and dolphins (Figure 7).

- ***Additional cap design measures***. Another conservation measure is to place fine-grained substrate and several clusters of boulders on top of the constructed cap. Placement of fine-grained substrate would likely involve two actions. The first would be to incorporate measures in the cap design that facilitate slowing water and trapping sand from the Willamette River. This would include the rock structure described above placed roughly in the same position at the existing dolphins and pilings. These would be emergent features during low water. The second action would be to place additional sand on top of the cap. This would provide a sand 'reserve' within the project area that the currents and waves could rework around the shallows. The intent is to provide a fine-grained veneer on top of the articulated concrete that could replace some of the lost rearing functions at the site. The purpose of the boulder clusters is to provide roughness and structure to the armor surface. EPA proposes to place 10 clusters of boulders throughout the shallow embayment (Figure 7).

- ***Willamette Cove Measures***. EPA also proposes to improve habitat functions in the adjacent Willamette Cove. The City of Portland documented the attraction of this site for out-migrating juveniles. Presumably, the cove provides important velocity and predator refuges and possibly some rearing functions. EPA proposes to remove the concrete structures, the abandoned barge and other debris along the shoreline and restore the fine-grained substrate of beach areas (Figures 9 and 10). EPA also proposes to remove approximately 50 creosote-treated pilings in Willamette Cove that would not otherwise need to be removed for placement of the sediment cap (Figure 10). The intent of this work is to allow greater use of the nearshore environment by out-migrants and to reduce predator habitat. In order to assure the permanence of the Willamette Cove measures, EPA (and DEQ) will work with Metro, owner of Willamette Cove, to establish permanent restrictions on future development along the shoreline and riverbank in Willamette Cove where the habitat improvements are to occur.

- ***Design Limitations***. Any structures or actions that EPA proposes to place within the nearshore area of the McCormick & Baxter site and Willamette Cove would be carefully considered to assure that they would not harm the integrity of the cap, they would not result in further diminishment of functional habitat, and they would not trap fish or result in degradation of water quality.

3. DURATION AND TIMING OF THE ACTION

Construction of the sediment cap and riparian area is subject to concurrence of NOAA Fisheries and USFWS on this BA addendum, completion of EPA's obligation for consultation with Tribal Nations, completion of EPA's consultation consistent with the National Historic Preservation Act, completion of the final design of the sediment cap and related construction documents, availability of Federal funds, approval of affected property owners such as Metro, the City of Portland and Burlington Northern Rail Road company, and procurement of a construction contractor by DEQ. The tentative schedule is to begin construction of the sediment cap in July 2004. Planting of the riparian area would begin in November 2004. Construction of the sediment cap would take 14 weeks. All in-water construction work would be completed by November 1, 2004. The sequence of construction events would be as follows:

- Demolition of in-water and shoreline structures (including those included in the conservation measures) would begin first and take approximately 4 weeks to complete.

- Cap placement would start as pilings are being removed. Work would begin in the shallow water reaches moving out towards deeper water. For the nearshore areas, the sand and organoclay components would be placed first, followed by the placement of the articulated concrete blocks. This work would take approximately 8 weeks to complete. The deep-water cap placement may require an additional 6 weeks.

- Bank grading and filling would start while the cap nears completion and would take approximately 2 weeks to complete.

- Planting of the riparian areas would occur in two phases after completion of the sediment cap, bank grading, and placement of the turf reinforcement mat. The herbaceous vegetation would be planted in the first phase and other vegetation such as shrubs and tree would be planted in the second phase. Phase one planting would occur immediately after completion of the bank grading and placement of the turf reinforcement mat. However, if construction is completed prior to October 1, planting herbaceous grasses would be delayed until late October or early November. This work would take approximately 1 weeks to complete.

Phase two planting would occur either the following February or a year later in February, depending on the maturity of the herbaceous grass.

4. DESCRIPTION OF ACTION AREA

The action area is the same as defined in the June 2002 Biological Assessment. Further details on the action area can be found in Section 4 of that document.[3]

[3]In June of 2002, the U.S. Fish and Wildlife Service made a determination that the Southwestern Washington/Lower Columbia River Sea-Run Cutthroat Trout did not warrant listing under the Endangered Species Act. The 2002 Biological Assessment included a discussion of this species that will not be continued in this document.

5. EVALUATING PROPOSED ACTIONS

EPA has focused the following discussion on the listed, candidate and proposed salmonid species because the majority of the work is in migration waters for these species. An expanded discussion for other species of concern is in Section 18 of this document and Section 18 of the June 2002 BA.

Section 5 of the June 2002 BA contains a full discussion on the biological requirements of federally listed or proposed threatened or endangered species. This addendum incorporates by reference the information in the 2002 Biological Assessment.

6. BASELINE CONDITIONS IN THE WILLAMETTE RIVER

This section describes habitat pathways and indicators important for salmonids in the riverine ecosystem. Riverine habitat is emphasized because of the potential effects of the proposed action on this type of habitat. For non-salmonid threatened and endangered species in the action area, EPA used a more narrative approach. The complexities of salmonid life histories and estuarine use warranted a more structured approach for the assessment of effects.

Section 6 of the June 2002 Biological Assessment contains a full discussion of the baseline conditions of the Willamette River. This addendum incorporates by reference the information in the 2002 BA. The subject of the 2002 BA was the construction of a containment barrier wall for the upland processing area of the site.

Existing data from the remedial investigations at McCormick and Baxter indicate that the current level of contamination in the sediments adjacent to the site are injurious to resident benthic organisms, which, in turn, may result in some level of harm to migratory fish populations (DEQ and EPA 1996). Direct exposure to contaminated groundwater and product may also result in harm (DEQ and EPA 1996).

Upon completion of the barrier wall (July 2003), EPA expects that there will be substantially less NAPL seeping from the upland site (close to 100% reduction), although there will be some residual product in the sediments outside of the wall. Direct exposure by organisms to contaminated groundwater and product will be significantly reduced. However, contaminated sediments as well as residual product will still remain a source of contamination. The sediment cap is intended to further reduce biotic exposure.

The McCormick and Baxter site will remain under DEQ long-term oversight to assure the efficacy of the remedial activities, and DEQ will conduct periodic reviews every five years of the remedy's protectiveness[4]. In conducting the five-year reviews, DEQ will monitor site media (i.e., groundwater, surface water and sediment) as well as

---

[4] Both CERCLA and the NCP require periods reviews of all federal sites where hazardous substances remain in place above levels that allow for unlimited use and unrestricted exposure, such as well caps are employed.

the integrity of the sediment cap (i.e., using bathymetry and visual inspections). A conceptual operations and maintenance plan for the sediment cap was provided in the Sediment Cap Basis of Design (DEQ 2002). DEQ is currently revising the conceptual operations and maintenance plan. A more detailed monitoring and maintenance plan including a sampling and analysis plan will be developed prior to construction of the sediment cap. In addition to physical monitoring activities, the five-year reviews will include continued evaluation of evolving standards for the protection of human and environmental health. Additional protective measures may be implemented as a result of site monitoring and/or the development of new standards.

Additional background information on the McCormick & Baxter Superfund Site can be found in the following documents:

• *Willamette Greenway Plan,* City of Portland, Bureau of Planning, November 1987.

• *Record of Decision*, McCormick and Baxter Creosoting Company Portland Plant, Portland, Oregon, March 1996, prepared by DEQ and EPA.

• *First Five-Year Review Report,* McCormick and Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, September 2001, prepared by DEQ and EPA.

• *Explanation of Significant Difference* (OU3 – Final Groundwater), McCormick and Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, August 2002, prepared by DEQ and EPA.

• *Sediment Cap Basis of Design*, McCormick & Baxter Creosoting Company, Portland, Oregon, May 2002, prepared by Ecology & Environment, Inc. for DEQ.

• *Draft Final Technical Plans and Specifications Sediment Cap*, McCormick & Baxter Creosoting Company, Portland, Oregon, June 2003, prepared by Ecology & Environment, Inc. for DEQ.

7. EFFECTS OF THE ACTION

The following sections provide EPA's analysis of the direct and indirect effects of the proposed action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent to the action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species [50 CFR §402.02]. The separate activities making up the proposed action are listed in Section 1 and discussed in the following sections.

EPA determined the effects on the listed, proposed and candidate species by predicting changes in baseline condition for each of the indicators.

8. WATER QUALITY HABITAT INDICATORS

8.1 TEMPERATURE

Removal of In-water Structures in the Willamette River. The existing in-water structures would be cut at the sediment surface and removed to a suitable disposal site. EPA evaluated pulling the structures from the sediments, but determined that this method has a greater potential for contaminant release from the sediments and by increasing turbidity of the contaminated sediments. This area also would be capped with the sediment cap. The proposed schedule for removâl is shown in Table 1. It is likely that the in-water structures would be removed by barge; however, EPA and DEQ would request contractor input on the most suitable method for removal. All work would be done in water, except for the most exposed pilings in shallow areas. There will likely be no changes to water temperature as a result of these activities.

Excavation and Grading of the Existing Bank. The excavation and grading of the bank would occur during the low water time of the year for the Willamette River and when most of the bank is located above OHW. The proposed schedule for excavation and grading of the existing bank is shown in Table 1. While there may be some indirect effect on water turbidity (see Section 8.2), no impact to water temperature is anticipated. EPA concludes there would be no change to water temperature as a result of these activities.

Removal of an Existing Bulkhead and Dock Remnant. The removal of these structures would occur during the low water time of the year for the Willamette River. The proposed schedule for removal of the existing bulkhead and dock remnant is shown in Table 1. Parts of these structures are located at and below OHW for the site; however, they are well exposed during the low water time of the year. Impacts for this activity on water temperature would be the same as those expected for the excavation and grading of the bank. As such, EPA concludes there will be no change to water temperature as a result of these activities.

Construction of a Sediment Cap in the Willamette River. Construction of the cap would be placed in water, with the possible exception of the higher shoreline elevations that may be exposed at the time of placement because of low river stage. The proposed schedule for construction of the sediment cap in the Willamette River is shown in Table 1. Very little research has been done on the changes in water temperature from placing dredged or fill materials in water (Warner pers. comm.). It is likely that there is some minimal change in ambient water temperature from increased activities in the water column, but not likely of such a magnitude or duration that would result in any measurable change.

After construction, the site would be shallower in depth than existing conditions. During the summer months, this may result in an increase in water temperature for the cap area. This increase in temperature would not likely be measurable throughout the action area, but might result in migrating fish avoiding the project site during the warmest parts of the summer months when high temperatures are of concern throughout the lower Willamette.

As such EPA concludes there would be no change to water temperature from placement of the cap, but that it might result in a degradation of baseline conditions for temperature after completion of the cap.

Planting Riparian Vegetation on the Completed Shoreline. Planting of the new shoreline with riparian vegetation would occur in two phases with herbaceous grasses being planted in November/December of 2004 and other vegetation being planted in February 2005, as shown in Table 1. Plantings would not occur in water, so there will likely be no change to water temperature as a result of these activities. After maturation of the riparian community (between 10 and 15 years), the vegetation may provide some temperature relief through shade along the nearshore environment during the summer months. EPA concludes that there would be no change (or a minor improvement over time) to water temperature as a result of these **activities.**

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.
- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.
- *Willamette Cove Measures* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action may result in degradation of the baseline conditions for water temperature in the action area because the constructed cap would create shallower nearshore conditions, which may experience an increase in water temperature during the summer months. These conditions may result in migrating salmonids avoiding the cap area and moving to deeper water. The conservation measures would result in more unobstructed available habitat in Willamette Cove and on the upriver areas of the McCormick and Baxter site.

8.2 SEDIMENTATION/TURBIDITY

Removal of In-water Structures in the Willamette River. This activity would cause localized sediment disturbance from snipping the pilings at the sediment line. In addition, the lack of structures in the water may result in more sediment movement from wave and current energies. This would be most noticeable immediately after the structures are removed; however, erosion is likely to continue because of the loss of in-water structures. Erosion will cease upon the completion of the cap. If necessary, a silt curtain will be installed during removal to limit any potential for increased surface water turbidity. Any changes in turbidity associated with this activity would be temporary in nature and limited in extent.

Excavation and Grading of the Existing Bank. This activity would occur largely above OHW and during the low water time of the year. This avoids and/or minimizes any direct impacts to water turbidity. During construction, the contractor would be required to control storm and/or construction water runoff from the site, which would reduce the likelihood of impacts to water turbidity. As such, EPA concludes there would be minimal impacts to water turbidity as a result of this activity.

Removal of an Existing Bulkhead and Dock Remnant. Most of this work would be done either at or slightly below OHW during the low water times of the year. As such, impacts to water turbidity would be the same as those for bank excavation and grading. The same construction controls would also be applied. EPA concludes that there would be minimal impacts to water turbidity as a result of this activity.

Construction of a Sediment Cap in the Willamette River. The cap would be constructed during the low water and lower velocity periods of the year. The cap materials would consist of sand, a limited area of organophyllic clay (for creosote beach seep), 6-inch minus rock, articulated concrete block, and possibly 10-inch minus rock. The sand and organophyllic clay would be placed directly on the contaminated sediments. The articulated concrete block and rock would be placed on top of the clean sand and/or clay to protect them from erosive forces.

EPA expects the sand layer to settle out quickly with only localized increases in background turbidity levels. This is typical of coarse-grained capping materials. For example, EPA (1994) evaluated total suspended solids (TSS) during the construction of a sediment cap in Eagle Harbor (Bainbridge Island, Puget Sound, Washington) and found that conditions returned to background within 30 minutes after a discharge period. They also found that turbidity had an expected increase in the areas of on-going sediment placement and that it was greatest at the bottom of the water column and limited in extent to the discharge area. The 2000/2001 cap placement at Eagle Harbor, Washington, which placed a greater amount of sand over a longer period of time than the 1994 cap, experienced some turbidity plumes during placement that were directly tied to movement of strong tidal currents. Monitoring indicated that the periodic plumes lasted between 4 to 6 hours before completely settling out with the majority of the material settling out within a few hours. EPA anticipates a similar experience at McCormick and Baxter where turbidity can be controlled through the methods of placement and that any increases in turbidity are expected to be limited in extent and duration. EPA would ensure that bid specifications include standards to minimize turbidity impacts, pursuant to a Water Quality 401 Certification.

Placement of the organophyllic clay (see Figure 6) would be more problematic; although, all of the sites are in shallow water (less than 10 feet). EPA would work closely with the manufacturer of the clay product for input on how to control turbidity at the placement site. The organophyllic clay placement at the seeps would be essentially dry placement at low water. Similar to sand placement, EPA would ensure that bid specifications include standards for turbidity to minimize turbidity impacts. See Section 18 for further specification details.

EPA expects turbidity increases with both the placement of the articulated concrete block, 10-inch minus rock and the 6-inch minus rock. In these cases, there would be some minor increases in turbidity from disturbing the bottom sediments (clean sand and clay) during placement. Some fines in the 10-inch and 6-inch minus rock may also contribute to turbidity. This is expected to be very minor, in both extent and duration.

EPA concludes that there would be an increase in turbidity during construction. EPA expects this to be limited in extent and duration, and would be timed to occur during low water, low-flow periods of the year and after times of peak out-migration.

Planting Riparian Vegetation on the Completed Shoreline. Planting of the new shoreline with riparian vegetation would occur as shown in Table 1. Plantings will not occur in water, so there will likely be no change to water turbidity as a result of these activities. EPA concludes that there would be no change to water turbidity as a result of these activities.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap .

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would temporarily degrade the baseline conditions for water turbidity in the action area because construction of the cap would increase water turbidity both through placement of clean cap materials and through re-suspension of bottom sediments. However, turbidity impacts are expected to be short in duration and limited in extent.

8.3 Water Contamination

Removal of In-water Structures in the Willamette River. Removal of the in-water structures would occur in areas known to have surface contamination of sediments. Any sediment that may be disturbed during removal could result in additional water contamination. EPA would ensure that bid specifications include standards to control re-suspension of contaminated sediments. This could include such measures as sediment fences, containment booms, silt curtains, etc. The contractor would also be required to adhere to State Water Quality Standards, pursuant to the Clean Water Act 401

Certification. Further specification detail is provided in Section 18. With these protective removal measures, there would be no changes to water contamination as a result of this activity.

Excavation and Grading of the Existing Bank. This activity would occur largely above OHW and during the low water time of the year. The bank consists of both clean and contaminated soil. The excavated materials would be disposed on the upland area of the project site. The materials would eventually be capped as part of the soil remedy. Any highly contaminated materials found during excavation would be disposed of off-site in an appropriate upland location. Direct contact with Willamette River water would be minimized to the maximum extent practicable. During construction, the contractor would be required to control storm and/or construction water runoff from the site, which would reduce the likelihood of impacts to water quality. Such controls include the preparation of (and adherence to) a detailed construction storm water management plan pursuant to requirements of EPA and State NPDES standards. See Section 18 for further details. As such, EPA concludes there would be no change to existing conditions as a result of this activity.

Removal of an Existing Bulkhead and Dock Remnant. This activity would occur largely above OHW and during the low water time of the year. The bulkhead and dock debris would be taken to an appropriate upland disposal site. Direct contact with Willamette River water would be minimized to the maximum extent practicable. During construction, the contractor would be required to control storm and/or construction water runoff from the site, which would reduce the likelihood of impacts to water quality. As such, EPA concludes there would be no change to existing conditions as a result of this activity.

Construction of a Sediment Cap in the Willamette River. Construction of the sediment cap would result in some re-suspension of contaminated sediments that may result in increased water contamination. When the cap material is placed in water, it can suspend or re-suspend bottom sediments upon impact. Palermo *et al.* (1998) provides extensive guidance on factors to consider when designing an *in-situ* cap. Re-suspension of contaminated bottom sediments is a critical consideration. However, much of this can be controlled by careful selection of the methods of placement and the type of capping materials. For example, at the Wyckoff Superfund Site in Eagle Harbor, Washington, EPA directed construction of a sediment cap (sand) over contaminated sediments (EPA 1994). The contaminated sediments at Wyckoff were largely organically enriched fine silts. The method of placement that best controlled re-suspension of the fine materials was to pressure wash sand from a barge. This allowed the coarser sediments to "rain" gently to the bottom rather than being dumped in large amounts. This placement method also entrained re-suspended sediments. This is consistent with their findings of the placement of an interim cap in 1994 (Nelson et al 1994).

The contaminated sediments at the McCormick and Baxter site are mostly coarse grained, as are the capping materials, which allow for better control of the construction site (coarser materials are less likely to re-suspend and they also drop out of the water column quickly). EPA would ensure that bid specifications contain performance based standards to minimize turbidity impacts. This includes requiring the contractor to indicate how they will implement and demonstrate adherence to State Water Quality Standards pursuant to the requirements of the Clean Water Act 401 certification. See Section 18 for further details. EPA concludes that there may be a short-term increase in water contamination as a result of this activity; however, the long-term effect would be to greatly reduce the overall exposure of the water column to contaminated sediment.

Planting Riparian Vegetation on the Completed Shoreline. Planting of the new shoreline with riparian vegetation would occur as shown in Table 1. Plantings would not occur in water, so there will likely be no change to water contamination as a result of these activities. Long-term maintenance, however, would require the selective use of herbicides to control invasive species until the riparian community becomes established. This may occur as often as once a year over a 10-year period. The City of Portland's Watershed Revegetation Program recommends using highly targeted applications of chemical controls (herbicide) as a tool against recolonization by invasive species until a healthy native herbaceous plant community can establish. This recommendation is based the City's experience with evaluating techniques to control invasive vegetation in areas where the city has tried to re-establish native vegetation communities. Their findings show that non-chemical techniques resulted in little success. The proposed herbicides are glyphosate (Roundup®, Roundup Pro®, Rodeo®) with the following surfactants: phosphatidylcholine (LI-700), methylacetic acid and alkyl poloxyethylene ether. Water and WEB oil would be used as carriers.

Herbicides would be applied at the project site where invasive species are hindering or would hinder the establishment of the native plant community. The Vegetation Management Strategy (Appendix A) contains the details of application.

There is little data documenting the effects of the proposed herbicides on aquatic ecosystems and the specific invertebrate prey of listed salmonids. The scientific studies that have been conducted on fish are largely limited to measures of acute mortality – i.e., the concentrations at which short-term exposures to a pesticide will kill fish outright, the standard lethal concentration (LC50). In many cases, actual mortality data may not be appropriate for estimating whether a pesticide will have adverse, non-lethal effects on the essential behavior patterns of salmonids (e.g., feeding, spawning, or migration) (WSDOE 2001).

Herbicides can enter water through atmospheric deposition, spray drift, surface water runoff, groundwater contamination and intrusion, and direct application. Although outright mortality from herbicide exposure is not expected at the project site, adverse effects could include reductions in reproductive success, weight loss, physiological effects (endocrine system, blood chemistry, liver function, etc.), and reduction in growth, prey capture ability, and swimming ability, all of which are associated with reduced survival (WSDOE 2001).

EPA proposes to apply the herbicide only under highly controlled conditions (see Appendix A). However, both herbicides are highly water soluble, which increases their likelihood of being transported off the application site through rain or surface water. Both Roundup® and Rodeo® herbicides degrade relatively quickly, and Rodeo® is approved for in-water applications in Washington State (WSDOE 2001). The risk remains, even with strict controls, that herbicides may reach the Willamette River and may result in sublethal direct effects to aquatic organisms, including salmonids. This impact would be temporary and minimal in extent.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would temporarily degrade the baseline condition for the following reasons:

- Construction may re-suspend contaminated sediments in the water column.

- Herbicides may reach surface waters.

- Habitat impacts would be short-term and limited in extent.

EPA also determined the action would provide long-term restoration of baseline conditions by isolating contaminated sediment from exposure to the water column and by removing additional sources of contamination (creosoted pilings, shoreline debris) from the project site and Willamette Cove.

Direct Effect on Species of Concern. This activity has a small potential to directly harm fish through herbicide exposure. Although herbicide applications can be strictly controlled and the potential for harm minimized by timing and application, some risk of direct effect would remain. As such, EPA concludes that this activity could potentially affect listed salmon and steelhead through sublethal effects of ***direct exposure*** during or immediately following application.

8.4 SEDIMENT CONTAMINATION

Removal of In-water Structures in the Willamette River. The removal of the in-water structures will not result in any change to baseline conditions for sediment contamination. This activity would cause localized sediment disturbance from snipping pilings at the sediment line, which may disturb (re-suspend) some contaminated sediments. However, this would not result in any change to existing baseline conditions.

Excavation and Grading of the Existing Bank. Excavation and grading of the existing bank would not result in any change to baseline conditions.

Removal of an Existing Bulkhead and Dock Remnant. Removal of these structures would not result in any change to baseline conditions.

Construction of a Sediment Cap in the Willamette River. The cap would be placed over highly contaminated Willamette River sediments. The resulting substrate will no longer be a source of potential contamination to sediment and would serve to isolate contaminated sediment from human exposure and biological uptake. This activity would improve baseline conditions for sediment contamination.

Planting Riparian Vegetation on the Completed Shoreline. This activity would have no effect on baseline conditions.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA concludes that the action would maintain baseline conditions during construction. EPA also concludes that this action would restore the baseline conditions by capping and isolating existing contaminated sediments.

9. HABITAT ACCESS INDICATORS

9.1 PHYSICAL BARRIERS

Removal of In-water structures in the Willamette River. The existing in-water structures are likely not hindering salmonid migration at this site because they run parallel to the shoreline, although they serve as cover for predators of juvenile fish. Most of these structures must be removed for the construction of the cap. This activity may serve to improve habitat conditions by removing predator habitat and by removing creosote treated wood from the aquatic environment.

Excavation and Grading of the Existing Bank. This work would be done above OWH and would have no effect on baseline conditions.

Removal of an Existing Bulkhead and Dock Remnant. This work would be done mostly above OWH and would have no effect on baseline conditions.

Construction of a Sediment Cap in the Willamette River. The sediment cap would increase the bottom elevation of the shoreline by approximately 3 feet over the 25-acre cap area. The cap would not be a physical barrier that would preclude migration along the shoreline although more shoreline would be exposed during low water times of the year. This would have minimal effect on baseline conditions.

Planting Riparian Vegetation on the Completed Shoreline. This work would be done mostly above OWH and would have no effect on baseline conditions.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would improve or restore the baseline condition for physical barriers in the action area by removing physical structures from the nearshore environment.

10. HABITAT ELEMENTS INDICATORS

10.1 LARGE WOODY DEBRIS

Removal of In-water structures in the Willamette River. The existing in-water structures consist of creosote treated wood that serves little or no salmonid habitat function as large woody debris. There would be no changes to large woody debris as a result of this activity.

Excavation and Grading of the Existing Bank. Driftwood and other debris collect in fairly significant amounts along the higher elevations of the shoreline and likely provide some function during high flows. Significant logs and other natural large woody materials would be moved during grading of the shoreline and stored on site. To the extent practicable, the large woody material would be returned to the shoreline after completion of construction. The removal of this material during the construction period would remove the availability of large woody debris as habitat. This action would temporarily degrade the baseline condition for large woody debris at the project site.

Removal of an Existing Bulkhead and Dock Remnant. The bulkhead and dock create a steep profile along the bank that does not facilitate woody debris collection. Construction would not change baseline conditions. After construction, the bank line would be more conducive to woody debris collection, which would result in an improvement of baseline conditions.

Construction of a Sediment Cap in the Willamette River. The construction of the sediment cap would require the removal of existing large woody debris along the upper elevations of the shoreline. Significant logs and other natural large woody materials would be moved during grading of the shoreline and stored on site. The woody debris would be returned to the shoreline after completion of construction. The removal of this material during the construction period would remove the availability of large woody debris as habitat. This activity would temporarily degrade the baseline condition for large woody debris at the project site.

Planting Riparian Vegetation on the Completed Shoreline. This activity would create a native riparian forest that would become a source for large woody debris once the forest matures. This activity would improve baseline conditions at the project site.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would temporarily degrade baseline conditions because large woody debris would be removed during construction. The action would improve or restore baseline conditions over time for the following reasons:

- More shoreline would be available for woody debris accumulation after removal of the bulkhead creosote dock remnants, pilings, and shoreline structures and debris in Willamette Cove.
- The riparian forest would eventually become a source of large woody debris.
- Appropriate large woody debris would be returned to the shoreline after construction.

10.2 Shallow Water Habitat

Removal of In-water Structures in the Willamette River. The existing in-water structures may provide complexity within the existing shallow water habitat, which would be lost after removal. In addition, the in-water structures (e.g., pilings) likely serve to slow or modify river currents, which allows for sand to settle out along the shoreline and also create a velocity refuge for salmonids during migration. Removal of the piles would result in a degradation of baseline conditions at the project site.

Excavation and Grading of the Existing Bank. Most of the work for this activity would occur above OHW and would not result in any impacts to existing shallow-water habitats. After construction, the lower reaches of the graded bank would be subject to inundation during high water events. This would result in more shallow water habitat (likely for velocity refuge) available to migrating salmonids. This activity would likely improve baseline conditions over time.

Removal of an Existing Bulkhead and Dock Remnant. This activity would occur at or above OLW. After construction, additional shoreline at this location would be available for use as shallow water habitat during high water events (similar to conditions described in the preceding paragraph). This activity would likely improve baseline conditions over time.

Construction of a Sediment Cap in the Willamette River. Based on recent studies of the Willamette River and Lake Washington, shallow water areas with sandy substrates are preferred habitat by migrating juvenile salmonids. The habitat provides feeding and some of the most important refuge from both predators and from high river velocity. Construction would preclude use of the site by out-migrating juveniles, although the proposed construction period may avoid the major out-migration. This site may be used as a velocity refuge for in-migrating adults, however, the construction would also occur at a time of lower river velocities.

After project construction, the resulting area would be of a different substrate (concrete and rock) and be at a higher elevation than the existing habitat. This change in substrate would provide minimal or no feeding habitat and the change in elevation may reduce the amount of predator and velocity refuge. EPA estimates that approximately 8 acres of shallow water habitat would emerge as open beach earlier in the season and more often in low water conditions than existing conditions. This would reduce the availability of habitat as velocity and predator refuge. During high river stages, approximately 5 acres the proposed graded bank would be inundated because of gentler slopes. As such, more habitat would be available along the upper reaches of the bank, which would provide benefits during high water and/or flood events. However, habitat impacts would be most acute during the later stages of the out-migration (late spring/early summer) when the river stage normally drops, during drought years when the river stage is abnormally low, and during summer and fall migrations by both juveniles and adults when the river stage is normally low. This activity would degrade baseline conditions.

Planting Riparian Vegetation on the Completed Shoreline. The riparian plantings would not change existing shoreline habitat. It would increase habitat complexity during high river stages and/or flood events, but would not likely provide shallow water habitat during most stages of the river. This activity would result in no change in baseline conditions.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would degrade the baseline condition for shallow water habitat in the action area for the following reasons:

- Removal of the in-water structures would likely reduce the velocity refuge that current exists.
- Construction of the cap would change the substrate from sand to concrete and rock, which would result in little or no feeding habitat.
- Construction of the cap would result in less available velocity and predator refuge.

The conservation measures, however, would open up additional shallow water habitat by removing structures, pilings, and debris from the project site and Willamette Cove for use by migrating salmonids. It would also replace the function of trapping finer sediments (sand) in the nearshore areas of the project site.

The project would improve baseline conditions during high water and/or flood stages because of the graded bank and the riparian plantings. In summary, there would be a loss of habitat during lower river stages and an increase of habitat during high water and/or flood stages.

11. CHANNEL CONDITIONS AND DYNAMICS INDICATORS

11.1 STREAMBANK CONDITION

Removal of In-water Structures in the Willamette River. Removal of the existing pilings would not change the characteristics of the existing shoreline, but it might expose the shoreline to increased wave and current energy.

Excavation and Grading of the Existing Bank. This activity would result in a more natural slope than the existing banks and allow for more interaction with the aquatic environment (more inundation, more availability of organic detritus). This activity would improve the characteristics of the existing bank.

Removal of an Existing Bulkhead and Dock Remnant. This activity would result in a more natural slope than the existing banks and allow for more interaction with the aquatic environment (more inundation, more availability of organic detritus). This activity would improve the characteristics of the existing bank.

Construction of a Sediment Cap in the Willamette River. This activity would have no effect on the existing streambank characteristics because it would be constructed below the existing bank.

Planting Riparian Vegetation on the Completed Shoreline. The riparian plantings, along with bank grading, would result in a more natural slope and habitat characteristic than what currently exists and would allow for more interaction with the aquatic environment. This activity would improve the characteristics of the existing bank.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would improve or restore baseline conditions for streambank conditions in the action area because it would result in a more natural appearing and functioning streambank than the current conditions.

11.2 FLOODPLAIN CONNECTIVITY

Removal of In-water Structures in the Willamette River. This activity would have no effect on floodplain connectivity.

Excavation and Grading of the Existing Bank. By grading and creating a more natural slope, which would be flooded during high water and/or flood stages, there would be an increase in the area and function of the floodplain at the project site. This activity would improve baseline conditions.

Removal of an Existing Bulkhead and Dock Remnant. By removing the hard shoreline features and creating a more natural slope, which would be flooded during high water and/or flood stages, there would be an increase in the area and function of the floodplain. This activity would improve baseline conditions.

Construction of a Sediment Cap in the Willamette River. This activity would have no effect on floodplain connectivity.

Planting Riparian Vegetation on the Completed Shoreline. This activity would have no effect on floodplain connectivity.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap .

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would maintain, improve, or restore baseline conditions for floodplain activity in the action area because it increases the area and quality of floodplain at the project site.

12. WATERSHED CONDITIONS

12.1 DISTURBANCE HISTORY

Removal of In-water Structures in the Willamette River. Removing the structural remnants of past activities at the site would maintain or improve existing conditions.

Excavation and Grading of the Existing Bank. This activity would create a more naturally appearing bank at the site, and would maintain or improve the existing conditions.

Removal of an Existing Bulkhead and Dock Remnant. This activity would create a more naturally appearing bank at the site, and would maintain or improve the existing conditions.

Construction of a Sediment Cap in the Willamette River. This activity would result in an artificially hardened substrate for 25 acres of existing shoreline. This would degrade existing conditions.

Planting Riparian Vegetation on the Completed Shoreline. This activity would create a more naturally appearing bank at the site, and would maintain or improve the existing conditions.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.
- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.
- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would degrade baseline conditions for disturbance history in the action area because of the creation of the hardened substrate of the cap area. However, past disturbances would be somewhat mitigated by the restoration of the bank to more natural appearing and functioning conditions. The conservation measures would also remove a significant amount of anthropogenic debris and structures for the shoreline of the project site and Willamette Cove. This would assist in improving or restoring baseline conditions surrounding the cap area.

12.2 RIPARIAN RESERVES

Removal of In-water Structures in the Willamette River. This activity would have no effect on existing riparian reserves.

Excavation and Grading of the Existing Bank. This activity would have no effect on existing riparian reserves.

Removal of an Existing Bulkhead and Dock Remnant. This activity would have no effect on existing riparian reserves.

Construction of a Sediment Cap in the Willamette River. This activity would have no effect on existing riparian reserves.

Planting Riparian Vegetation on the Completed Shoreline. This activity would create a riparian forest in an area that has little intact riparian vegetation and provides little functional benefit. The existing riparian vegetation is dominated by invasive understory species. The resulting riparian planting would create a native plant community and increase the connectivity between the aquatic habitat and native terrestrial vegetation. This activity would restore baseline conditions.

Conservation Measures On-Site and At Willamette Cove. Implementation of the conservation measures would have similar impacts as listed above for all of the actions:

- *Removal of existing structures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

- *Protection of the nearshore environment.* This would result in similar impacts as listed above for construction of the sediment cap.

- *Willamette Cove Measures.* This would result in similar impacts as listed above for removal of shoreline structures and pilings.

Effect on Baseline. EPA determined that the action would restore baseline conditions for riparian reserves in the action area because additional area of riparian reserves would be created.

Table 2 provides a summary of all the indicators and expected changes in conditions as a result of the proposed project.

13. BENEFICIAL EFFECTS

EPA, through its responsibilities under CERCLA, has concluded that sediments at McCormick and Baxter are contaminated with hazardous substances. EPA also concluded that if the remedial actions specified in the ROD are not undertaken, the actual or threatened releases of hazardous substances might present an imminent and substantial endangerment to human health and/or the environment. As such, EPA is required to pursue actions that will control the release of hazardous substances.

There will be significant beneficial effects as a result of this action. Specifically, this action would contain contaminated sediment, which is a significant source of water and sediment contamination. This will also significantly reduce the exposure of fish and wildlife to hazardous substances, reduce risk to human health through exposure, and will assist in the improvement of sediment and water quality on the Willamette River by isolating contaminated materials. The action will reverse the trend of continued degradation of the riverine environment.

There will also be a significant portion of the existing shoreline that will be improved or restored to more natural functions within the nearshore and riparian environment of the project site and Willamette Cove.

14. INTERRELATED AND INTERDEPENDENT EFFECTS

Interdependent actions are those that have no independent utility apart from the action being considered. Interrelated actions are activities that are part of the larger action and depend on the larger action for their justification. The proposed sediment cap, as part of the remedy for contaminated Willamette River sediment, includes a barrier wall (see June 2002 BA) and a future upland soil cap. An additional biological assessment addendum will be prepared for the soil cap once the design and implementation details have been substantially completed, which is estimated to be 2004 or 2005.

15. Cumulative Effects

Cumulative effects are defined in 50 CFR part 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." The action area for this project encompasses a significant portion of the Willamette River. This area is currently a disturbed riverine ecosystem altered by previous dredging, backfilling, sewage and industrial discharges, and other anthropogenic activities over the past 100 years. Future Federal actions, including additional clean-up activities, navigational dredging, and activities permitted under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, would be reviewed under separate Section 7 consultation processes and are not considered cumulative effects.

The clean-up activities have the potential to increase public interest in the site for educational purposes, recreational activities, or other shoreline amenities. Activities requiring Federal permits or Federal funding will be subject to Section 7 review.

16. CONCLUSION

The action area has degraded baseline conditions. The proposed action would contain a source of sediment contamination thereby resulting in improved baseline conditions for certain aspects of habitat supporting threatened or endangered species. However, the project will result in the loss of habitat at the site. Although this habitat loss is of great concern to EPA, the overall benefits of the remedial action on aquatic resources outweigh potential impacts. **The conservation measures proposed within the previous discussion and in Section 18 are intended to lessen the potential impacts the proposed project.**

16.1 CHINOOK SALMON (LOWER COLUMBIA RIVER ESU, UPPER WILLAMETTE RIVER ESU)

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the sediment cap. Thus, in the long-term, the remedial action would address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in degrading baseline conditions for water temperature, shallow water habitat, and disturbance history. In addition, there is risk of direct harm through exposure to herbicides. It is EPA's determination that the project **may adversely affect Chinook salmon.**

16.2 STEELHEAD (LOWER COLUMBIA RIVER ESU, UPPER WILLAMETTE RIVER ESU)

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the sediment cap. Thus, in the long-term, the remedial action would address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in degrading baseline conditions for water temperature, shallow water habitat, and disturbance history. In addition, there is risk of direct harm through exposure to herbicides. It is EPA's determination that the project **may adversely affect steelhead.**

16.3 Columbia Chum Salmon

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the sediment cap. Thus, in the long-term, the remedial action would address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in degrading baseline conditions for water temperature, shallow water habitat, and disturbance history. In addition, there is risk of direct harm through exposure to herbicides. It is EPA's determination that the project **may adversely affect chum salmon.**

16.4 Lower Columbia River/Southwest Washington Coho Salmon

Containment of the source of sediment and river contamination (NAPL) is the primary purpose of the sediment cap. Thus, in the long-term, the remedial action would address unacceptable risks to the environment and public health, and reduce the levels of contamination in sediment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in degrading baseline conditions for water temperature, shallow water habitat, and disturbance history. In addition, there is risk of direct harm through exposure to herbicides. It is EPA's determination that the project **will not jeopardize** the continued existence of this population.

17. CRITICAL HABITAT

Areas where the physical and/or biological features are essential to the conservation of the listed species are considered critical habitat. The Columbia and Willamette Rivers provide critical feeding, resting, and refuge functions important to the salmonid species covered under this document.

Critical habitat would be adversely impacted by this action through the loss and modification of shallow water habitat at the project site.

18. Conservation Measures

The following conservation measures will reduce or eliminate potential impacts to the listed anadromous fish species.

Avoidance/Minimization of Short-Term Effects

- To the extent feasible, all in-water work would be done during summer/fall low water months (July 1, 2004 through October 31, 2004) to minimize impacts to out-migration of juvenile salmonids. In the event that in-water construction work is not completed within this timeframe, any necessary follow-on work would occur during the Oregon Department of Fish & Wildlife's designated fall/winter in-water work period for the Lower Willamette River (December 1, 20004 through January 31, 2005) or during the following year's summer/fall in-water work period (July 1, 2005 through October 31, 2005).

- A comprehensive biological monitoring and reporting program will be developed prior to construction and employed during construction to ensure measures provided in this Biological Assessment and the ensuing Biological Opinion are effective in minimizing the likelihood of take from permitted activities. In implementing the monitoring and reporting program, an environmental professional will monitor and document on a daily basis the conditions of the shoreline and nearshore area during construction. Furthermore, a qualified biologist will be on-site during the construction period. A qualified fish biologist will be on-site during the first two days of the beginning of each construction sequence to assure fish protection measures are in place and functioning.

- EPA (and DEQ) will require the contractor to adhere to water quality protections and other conditions found in the Water 401 Quality Certification for this action. This document is currently in progress, but will be completed prior to procurement of the construction contractor.

- If an uncontrolled event such as a sizable sheen or seepage were observed, the existing protective measures would be reevaluated for efficacy. If deemed necessary by the environmental professional, work may be stopped until the cause of the event is determined and work can be resumed without additional impacts.

- EPA (and DEQ) will require that all prudent and necessary steps be taken during construction to avoid and minimize potential water and sediment quality impacts during construction. These will include strict contractor performance controls for all nearshore and in-water construction activities. EPA (and DEQ) will require the contractor to submit a Storm Water Pollution Prevention Plan (SWPPP) and Spill Prevention and Control Plan (SPCC) required by the general NPDES permit for construction. Based on the following:

  a) "Processes, Procedure, and Methods to Control Pollution Resulting from All Construction Activity," EPA 43019-73-007.

  b) "NPDES Stormwater Regulations for Construction Projects," Oregon Department of Environmental Quality, November 2002

- The contractor will be required to provide sorbant booms, pads, and other sorbant materials and vacuum pumps to remove and isolate any sheen or product seep resulting from construction activities.

- The contractor will be directed to take extraordinary care to prevent soil or debris from being deposited on the beach during piling removal.

- An oil containment boom will be employed during all piling removal activities. The boom shall encircle the areas where pilings are being removed. This boom shall also serve to collect any floating debris.

- Oil absorbent materials will be employed if visible product is observed. The booms will remain in place until all oily material and floating debris has been collected and the sheens have dissipated.

- Oil absorbent pads will be employed if visible contamination occurs, beyond routine sheens, as directed by the DEQ construction oversight manager.

- Debris netting will be available to collect and remove floating material or debris during all demolition and removal activities.

- Pilings, broken stubs, and associated sediments (if any) will be contained on a barge (if a barge is used during piling removal). If a barge is not used during the removal of pilings, removed pilings, broken stubs, and associated sediments shall be contained in a designated upland storage area. The perimeter of the barge or the upland storage area shall be encircled by of a row of hay or straw bales, or filter fabric, to allow for dewatering of the sediments and run-off from piles.

- Acceptance criteria for the material to be used for construction of the sediment cap will be specified in the final design specifications. It is EPA's expectation that this material will not contain detectable levels of organic contaminants and will have background level concentrations of metals.

- All cap materials will be placed in a controlled and accurate manner. EPA (and DEQ) will direct the contractor to avoid using equipment and placement rates that result in the displacement of and/or excessive mixing with the river sediments to be capped.

- Armor stone will be placed in a manner that does not disrupt or penetrate the other cap components.

- Bank grading will be done in dry weather when possible.

- Appropriate LWD will be moved carefully and returned to its original location after construction.

- Construction equipment will be serviced, stored and fueled at least 100 feet away from the shoreline. EPA (and DEQ) will require that any equipment used on the beach shall be checked for oil leaks and other potential environmental hazards on a daily basis. No equipment posing environmental hazards shall be operated on the beach.

Other Measures

- EPA (and DEQ) has incorporated habitat enhancement measures into the project design. These include the creation of a more natural bank and shoreline and the planting of a native riparian-forested community along the finished shoreline.

- In additional to design measures, EPA proposes conservation measures discussed within the body of the text (see Section 2.6) to further offset potential harm from project impacts.

- EPA (and DEQ) will conduct periodic reviews every five years of the sediment cap's protectiveness. In conducting the five-year reviews, DEQ will monitor site media (i.e., groundwater, surface water and sediment) as well as the integrity of the sediment cap (i.e., using bathymetry and visual inspections). In addition to physical monitoring activities, the five-year reviews will include continued evaluation of evolving standards for the protection of human and environmental health. Additional protective measures may be implemented as a result of site monitoring and/or the development of new standards.

- EPA (and DEQ) will work with Metro, owner of Willamette Cove, to establish permanent restrictions on future development along the shoreline and riverbank in Willamette Cove where the habitat improvements are to occur.

19. EFFECTS OF THE PROPOSED ACTION ON OTHER LISTED SPECIES

19.1 BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The effect of the proposed action to bald eagles may be disturbance by noise during construction. It is likely that the eagles will avoid the immediate area.

Any interference with eagle activity will end when construction is completed. The effects are expected to be localized and temporary. In addition, local bald eagle populations are likely accustomed to various activities, as this is a heavily industrialized area. Long-term degradation of eagle habitat is not expected. Survival and reproductive success of eagles would be unaffected. Containment of contaminated sediments will reduce the likelihood of direct exposure. The planting of riparian vegetation may also provide additional roosting habitat.

Cumulative, Interrelated or Interdependent Effects. There would be no significant cumulative, interrelated or interdependent effects on this species from the proposed project in conjunction with other projects or actions.

Conservation Methods. Conservation methods listed in Section 18 will also serve to minimize potential effects on bald eagles. No additional conservation measures are warranted.

Effect Determination. The proposed action would not result in any long-term degradation of habitat or other adverse effects on bald eagles. Short-term effects such as noise disturbance and reduced prey availability will not occur or would be very small in magnitude. The survival or reproductive success of eagles in the project vicinity would not be affected. Therefore, the proposed action **may affect, but is not likely to adversely affect the bald eagle**.

19.2 GOLDEN PAINTBRUSH (*CASTILLEJA LEVISECTA*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *C. levisecta.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *C. levisecta*

19.3 WATER HOWELLIA (*HOWELLIA AQUATILIS*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *H. aquatilis*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Howellia aquatilis.*

19.4 BRADSHAW'S LOMATIUM (*LOMATIUM BRADSHAWII*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *L. bradshawii.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lomatium bradshawii.*

19.5 NELSON'S CHECKER MALLOW (*SIDALCEA NELSONIANA)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *S. nelsoniana.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Sidalcia nelsoniana.*

19.6 WILLAMETTE DAISY (*ERIGERON DECUMBENS VAR. DECUMBENS*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *E. decumbens.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Erigeron decumbens var. decumbens.*

19.7 KINCAID'S LUPINE (*LUPINUS SULPHUREUS VAR. KINCAIDII*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of *L. sulphureus.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lupinus sulphureus var. kincaidii.*

19.8 OREGON SPOTTED FROG (*RANA PRETIOSA*)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly impact areas known to support or potentially support individuals or populations of Oregon spotted frog.

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects as a result of this action.

Conservation Methods. None

Effect Determination. The action would have **no** effect on Oregon spotted frog.

20. REFERENCES

Bachman, B. 2003. Wyckoff-Eagle Harbor Project Monitoring Manager, U.S. Army Corps of Engineers, Seattle District. Personal Communication.

LaSalle, M.W. (1990). Physical and Chemical Alterations Associated with Dredging in Effects of Dredging on Anadromous Pacific Coast Fishes. Charles A. Simenstad (Ed). Washington Sea Grant Program. University of Washington.

Nelson, E., A. Vanderheiden, and D. Schuldt. 1994. Eagle Harbor Superfund Project. In Proceedings of Dredging 1994, Second International Conference and Exhibition on Dredging and Dredged Material Placement. Prepared for U.S. Environmental Protection Agency, Washington State Department of Natural Resources, and Washington State Department of Ecology. Prepared by the U.S. Army Corps of Engineers.

Palermo, M.R., J.E. Clausner, M.P. Rollings, G.L. Williams, T.E. Myers, T.J. Fredette, R.E. Randall. 1998a. Guidance for Subaqueous Dredge Material Capping. U.S. Army Corps of Engineers Research Report Summary. Dredging Operations and Environmental Research Program. U.S. Army Engineer Waterways Experiment Station. TR-DOER-1.

Palermo, M.S. Maynord, J. Milner, and D. Reible. 1998b. EPA's Assessment and Remediation of Contaminated Sediments (ARCS) Program: Guidance for In Situ Subacquious Capping of Contaminated Sediments. U.S. Environmental Protection Agency, 905-B96-004, Great Lakes National Program Office, Chicago, Illinois.

U.S. Environmental Protection Agency (EPA). 1994. Record of Decision for Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit.

Washington State Department of Agriculture (WSDOA). 2001. A process for evaluating pesticides in Washington State surface waters for potential impacts to salmonids. Publication No. 052. Washington State Pesticide/ESA Task Force. 1-38 pp.

Warner, L.C. 2003. Biologist, Dredged Material Management Office (DMMO). U.S. Army Corps of Engineers, Seattle District. Personal Communication.

U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency, Washington State Department of Ecology, Oregon State Department of Environmental Quality, Washington State Department of Natural Resources. 1998. Dredge Material Evaluation Framework, Lower Columbia River. November 1998.

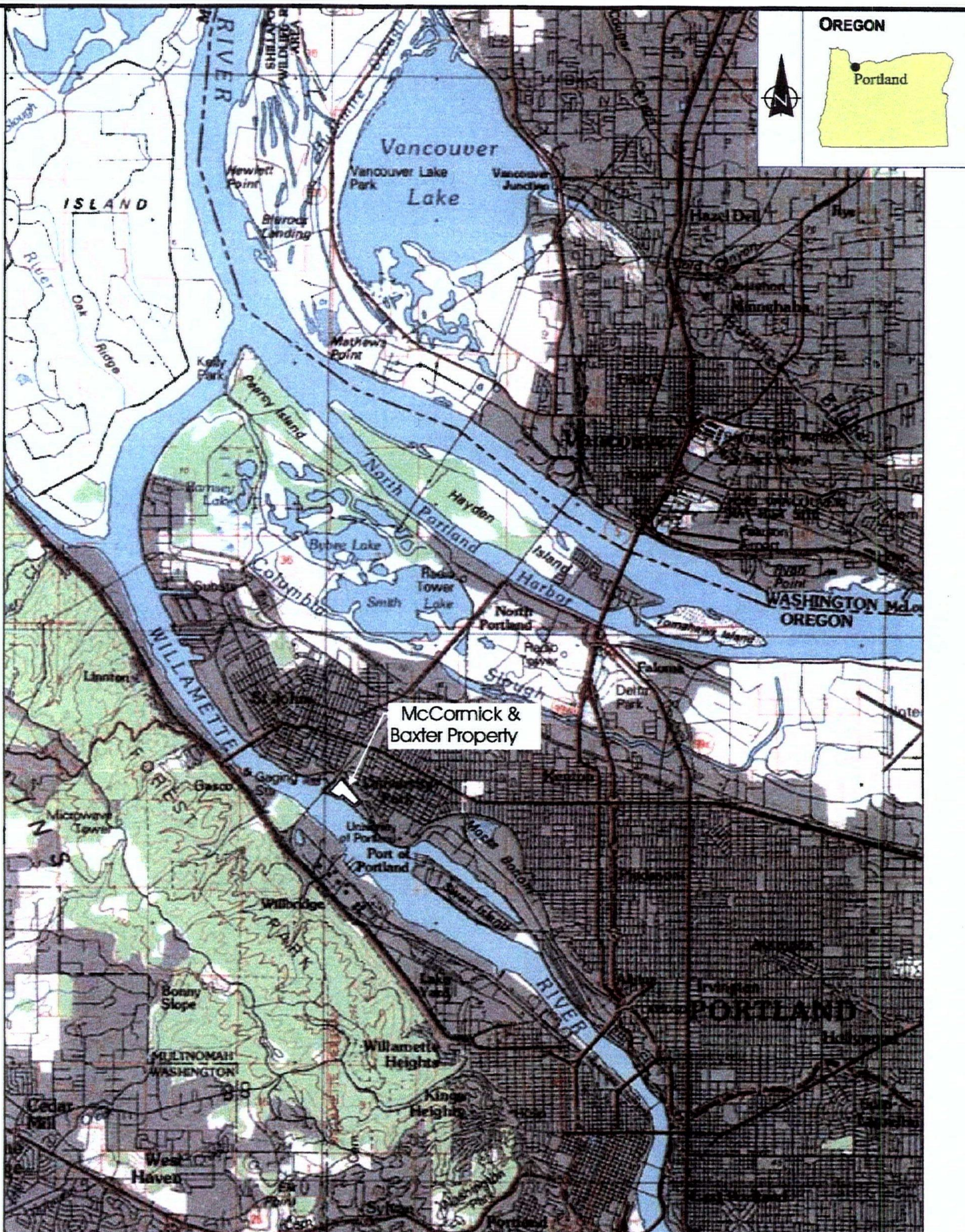
TABLE 1. PROPOSED CONSTRUCTION SCHEDULE

Task Name	Duration	Start	Finish
Fish Window	**17.4 wks**	Thu 7/1/04	Sun 10/31/04
Construction	**22 wks**	Tue 6/17/04	Fri 11/19/04
1. General	**22 wks**	Tue 6/17/04	Fri 11/19/04
Mobilization/Demobilization	**22 wks**	Tue 6/17/04	Fri 11/19/04
Field Mobilization	**2 wk**	Thu 6/17/04	Wed 6/30/04
Demobilization	**2 wks**	Mon 11/8/04	Fri 11/19/04
Submittals	**18.3 wks**	Tue 3/1/04	Mon 6/30/04
Clearing, Grubbing, LWD, Barge, Concrete Debris Removal	**3 wks**	Thu 8/26/04	Wed 9/15/04
2. Piling Removal	**6 wks**	Thu 7/1/04	Wed 8/11/01
Pulling, Dock, and Dolphin Removal	**6 wks**	Thu 7/1/04	Wed 8/11/01
Piling Transport and Disposal	**6 wks**	Thu 7/1/04	Wed 8/11/01
3. Surveying	**21.4 wks**	Thu 6/17/04	Fri 11/12/04
Bathymetric Survey	**18 wks**	Thu 6/17/04	Wed 10/20/04
Initial	**2 wks**	Thu 6/17/04	Wed 6/30/04
Final	**2 wks**	Thu 10/7/04	Wed 10/20/04
Upland Survey	**11.4 wks**	Thu 8/26/04	Fri 11/12/04
Initial	**1 wk**	Thu 8/26/04	Wed 9/1/04
Final	**1 wk**	Mon 11/8/04	Fri 11/12/04
4. Sediment Cap and Armoring	**16 wks**	Thu 7/1/04	Wed 10/20/04
Organoclay Material and Placement	**2 wks**	Thu 7/1/04	Wed 7/14/04
Sediment Cap Material and Placement	**3 mons**	Thu 7/1/04	Wed 9/22/04
Gravel Filter Layer Material and Placement	**3 mons**	Thu7/8/04	Wed 9/29/04
10-inch minus Rock Armoring Material and Placement	**3 mons**	Thu 7/15/04	Wed 10/6/04
ACB Material and Placement	**3 mons**	Thu 7/15/04	Wed 10/6/04
Sand Overlay	**2 wks**	Thu10/7/04	Wed 10/20/04
Rock Mound	**2 wks**	Thu 10/7/04	Wed 10/20/04
6-inch minus cobble Material and Placement	**3 mons**	Thu 7/15/04	Wed 10/6/04
5. Upland Work	**10.4 wks**	Thu 9/2/04	Fri 11/12/04
Abandon and improve Monitoring Wells	**14 days**	Thu 9/2/04	Tue 9/21/04
Bank Excavation and grading	**28 days**	Wed 9/22/04	Fri 10/29/04
Construct Soil Disposal Area	**14 days**	Thu 9/2/04	Tue 9/21/04
Geotextile Demarcation Layer	**2 days**	Wed 9/22/04	Thu 9/23/04
Transport Fill to Site	**10 days**	Wed 9/22/04	Tue 10/5/04
Placement of Fill	**10 days**	Wed 10/6/04	Tue 10/19/04
Vegetation - Phase 1[1]	**5 days**	Mon 11/8/04	Fri 11/12/04
TRM Anchor Trench and TRM Placement	**5 days**	Mon 11/1/04	Fri 11/5/04

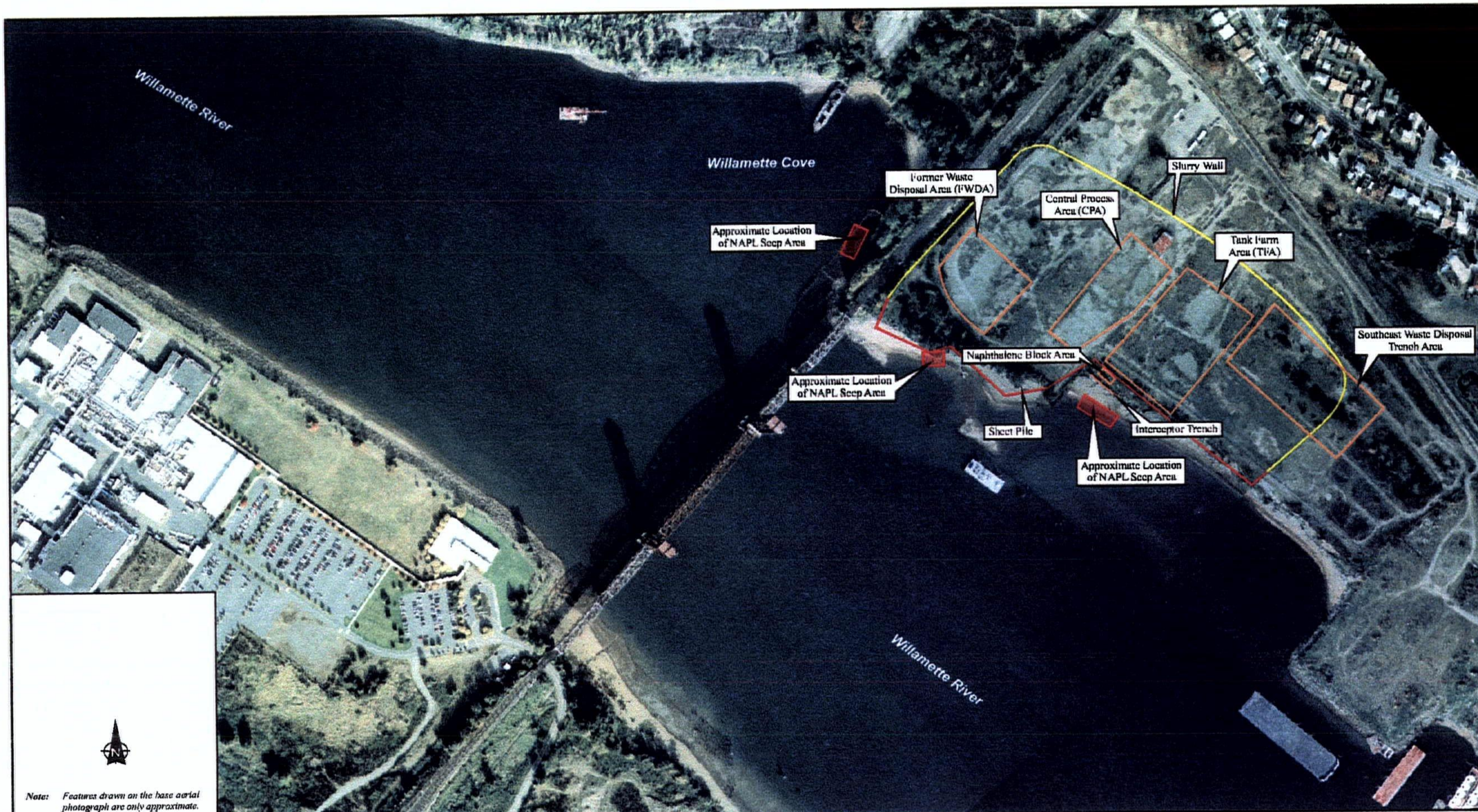
[1] *Note that Vegetation – Phase 2 to occur in February 2005*

TABLE 2. EXPECTED CHANGES TO BASELINE CONDITIONS

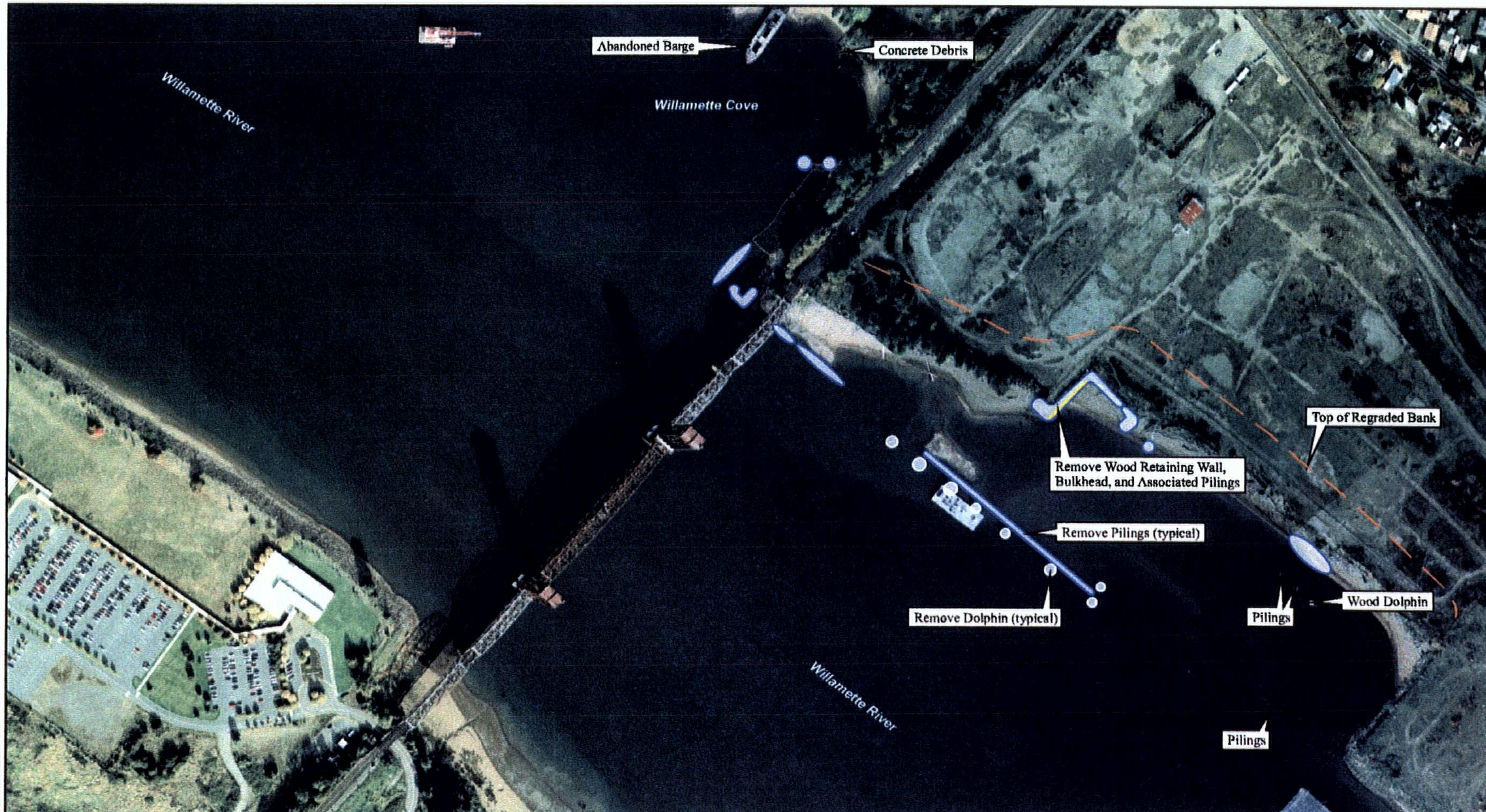
INDICATOR	EFFECTS			
	Improve or Restore	Maintain	Degrade Short Term	Degrade Long Term
WATER QUALITY				
Temperature				X
Sediment/Turbidity		X	X	
Water Contamination	X		X	
Sediment Contamination	X			
HABITAT ACCESS				
Physical Barriers	X			
HABITAT ELEMENTS				
LWD	X		X	
Shallow Water				X
CHANNEL CONDITIONS AND DYNAMICS				
Streambank Condition	X			
Floodplain Connectivity	X	X		
WATERSHED CONDITIONS				
Disturbance History	X (Riparian Shoreline)			X (Hardened nearshore cap)
Riparian Reserves	X			



ecology and environment, inc. International Specialists in the Environment Portland, Oregon	McCORMICK & BAXTER CREOSOTING CO. Portland, Oregon	Figure 1 SITE LOCATION MAP
	Date: 2-21-03	10:001688OY021402\fig 1



ecology and environment, inc. International Specialists in the Environment Portland, Oregon	0 500 1,000 Approximate Scale in Feet	McCORMICK AND BAXTER CREOSOTING COMPANY SITE Portland, Oregon	Figure 2 EXISTING SITE LAYOUT
			Date: 6/5/03 · Drawn by: AES · 10:001688OY021402\fig 2.cdr



ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon

0 360 720
Approximate Scale in Feet

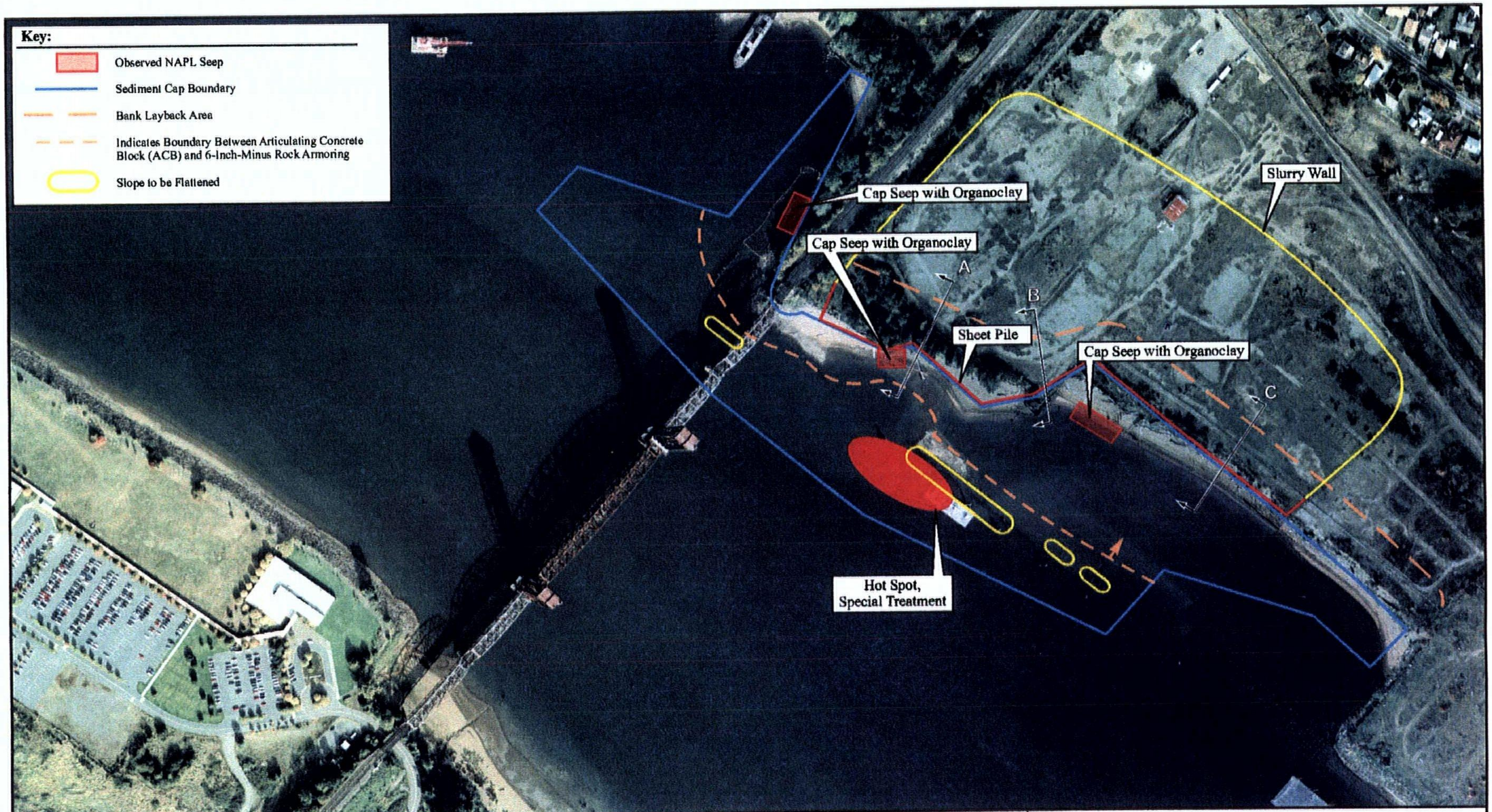
McCORMICK AND BAXTER
CREOSOTING COMPANY SITE
Portland, Oregon

Note: Features drawn on the base aerial photograph are only approximate.

Figure 3

EXISTING IN-WATER STRUCTURES AND BANK GRADING PLAN

Date:	Drawn by:	
6/5/03	AES	10:001688OY021402\fig 3.cdr



ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon

0 360 720
Approximate Scale in Feet

McCORMICK AND BAXTER
CREOSOTING COMPANY SITE
Portland, Oregon

Note: Features drawn on the base aerial photograph are only approximate.

Figure 4

EXISTING SITE AND PROPOSED SITE FEATURES

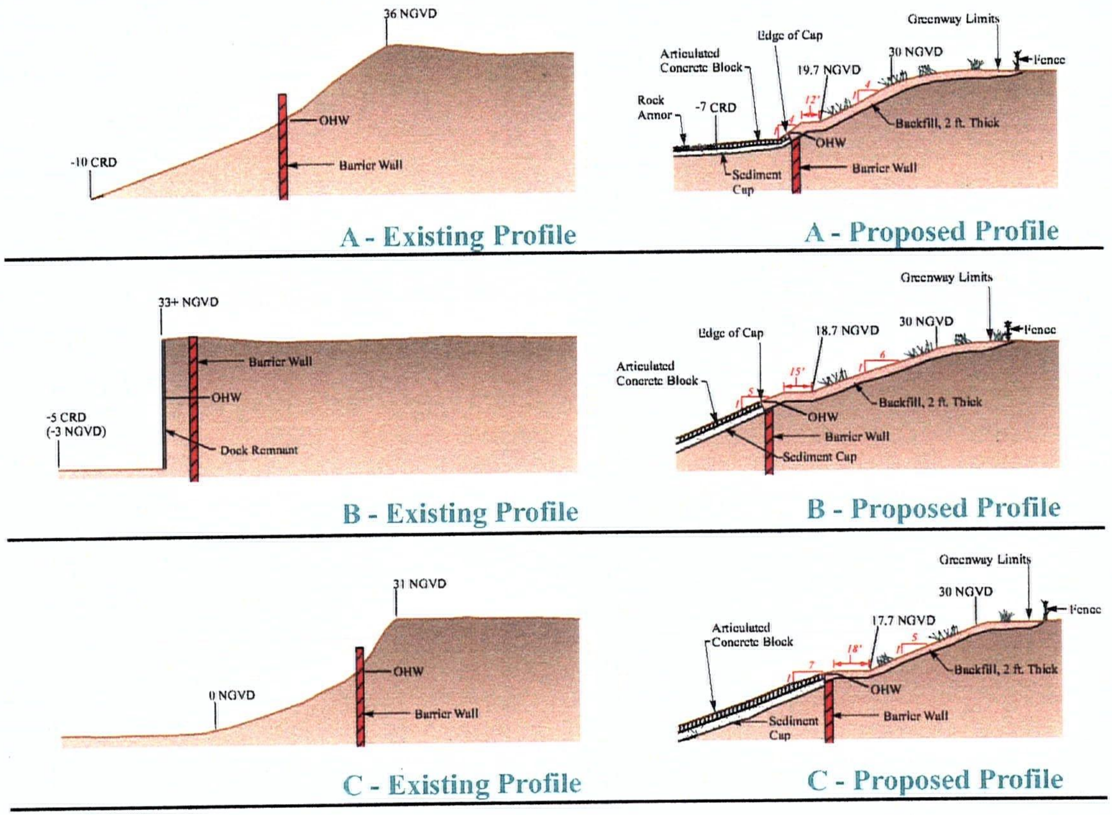
Date:	Drawn by:	
10/30/03	AES	10:001688OY021402\fig 4.cdr

Key:

CRD	Columbia River Datum
NGVD	National Geodetic Vertical Datum
OHW	Ordinary High Water
ACB	Articulated Concrete Block

Notes:

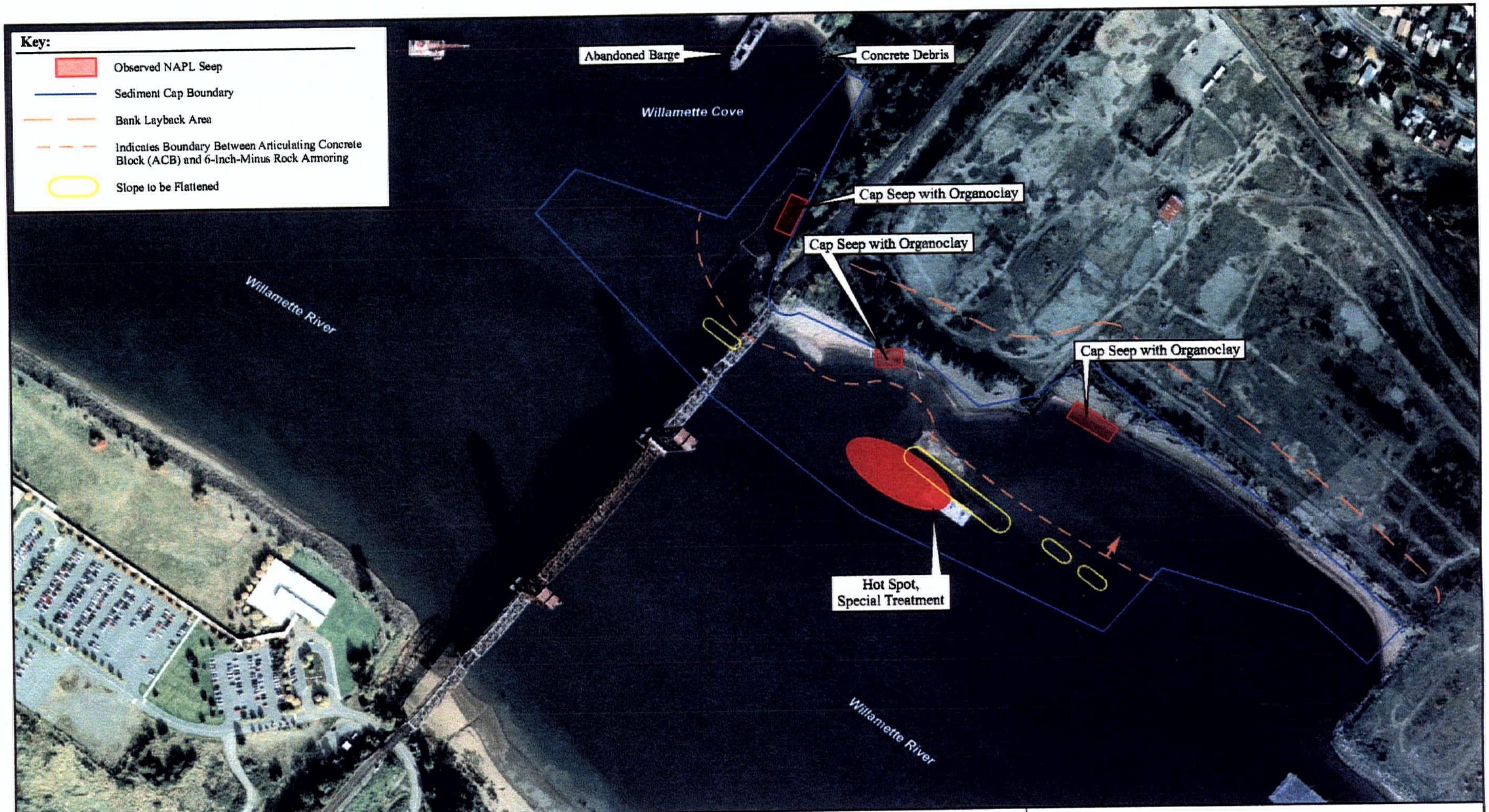
1. Regraded banks consist of:
   - geotextile on regraded surface
   - 1 ½ feet soil fill
   - ½ foot topsoil
   - herbaceous seeding
   - turf reinforcement mat
2. Vegetation as specified by the City of Portland Watershed Vegetation Program calls for the following zones:
   - Upper Riparian, 18.7 - 30 NGVD
   - Lower Riparian, 16.6 - 18.7 NGVD
   - ACB, 14.6 - 16.6 NGVD
3. Trees and shrubs are to be planted once the herbaceous material has been established.
4. Trees are to be planted at and above the terrace level, which varies across the site.



Not to Scale

ecology and environment, inc. International Specialists in the Environment Portland, Oregon	McCORMICK AND BAXTER CREOSOTING COMPANY SITE Portland, Oregon	Figure 5 EXISTING SITE AND PROPOSED SITE PROFILES

Date:	Drawn by:	
6/5/03	AES	10:001688OY021402\fig 5.cdr



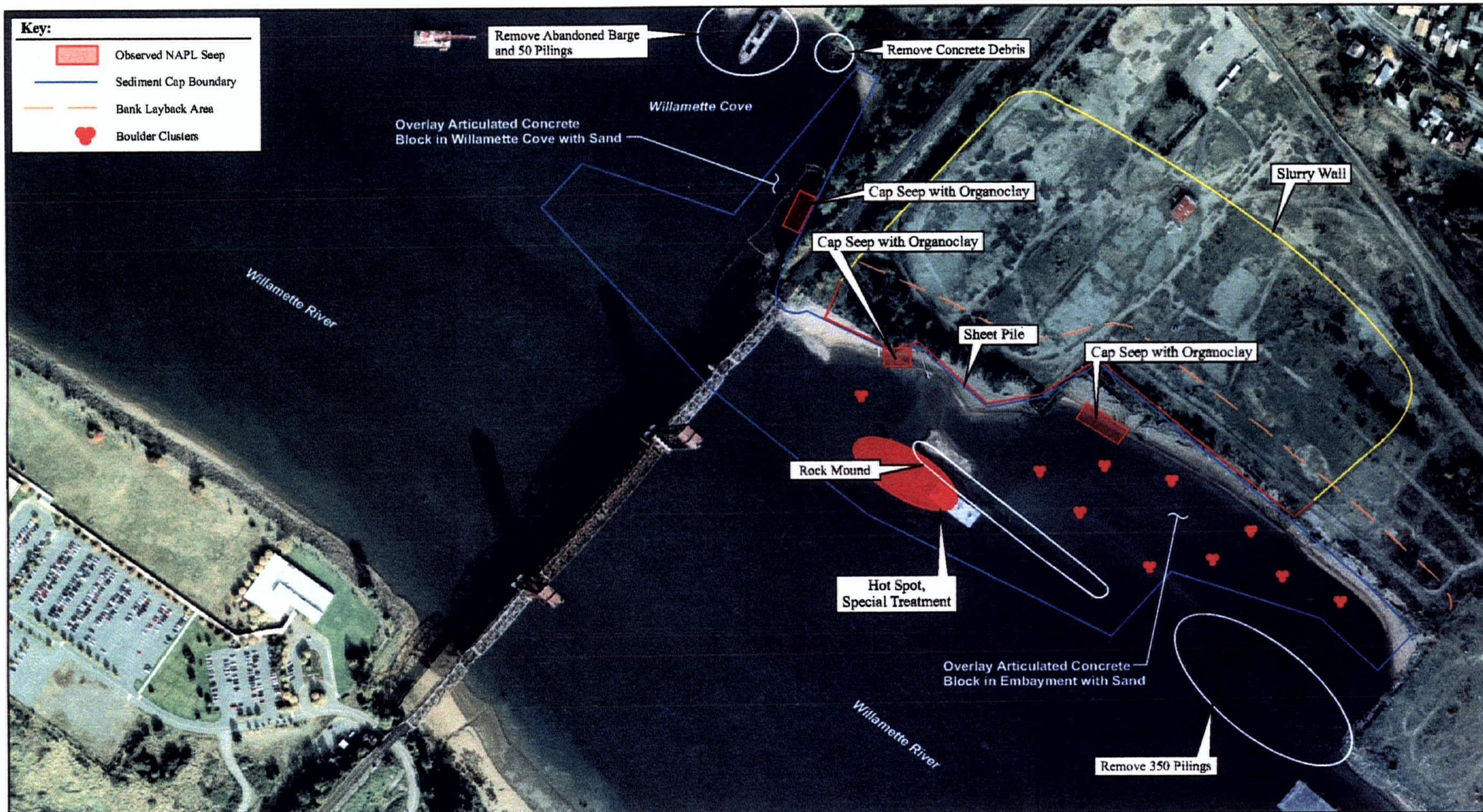
ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon

McCORMICK AND BAXTER
CREOSOTING COMPANY SITE
Portland, Oregon

Note: *Features drawn on the base aerial photograph are only approximate.*

Figure 6
PROPOSED CAP DETAILS

Date:	Drawn by:	
6/6/03	AES	10:001688OY021402\fig 6.cdr



ecology and environment, inc. International Specialists in the Environment Portland, Oregon	0 360 720 Approximate Scale in Feet	McCORMICK AND BAXTER CREOSOTING COMPANY SITE Portland, Oregon	Figure 7 PROPOSED ADDITIONAL CONSERVATION MEASURES
		Note: Features drawn on the base aerial photograph are only approximate.	Date: 6/6/03 — Drawn by: AES — 10:001688OY021402\fig 7.cdr

DEQ State of Oregon Department of Environmental Quality	McCormick and Baxter Creosoting Company Site Portland, Oregon	Figure 8 Proposed Removal of 350 Creosote-Treated Pilings Outside of Sediment Cap Boundary

DEQ
State of Oregon Department of Environmental Quality

McCormick and Baxter
Creosoting Company Site
Portland, Oregon

Figure 9
Proposed Removal of Concrete Debris Along Shoreline in Willamette Cove

DEQ State of Oregon Department of Environmental Quality	McCormick and Baxter Creosoting Company Site Portland, Oregon	Figure 10 Proposed Removal of Abandoned Barge and 50 Creosote-Treated Pilings in Willamette Cove

APPENDIX A

Vegetation Management Strategy

McCormick & Baxter Creosoting Company Superfund Site

Portland, Oregon

Submitted to:
Kevin Parrett, Project Manager
Oregon Department of Environmental Quality

January 2003

By Scott Clement
City of Portland, Watershed Revegetation Program

(DEQ Agreement No. 057-03)

1. Introduction

Project Scope

The Watershed Revegetation Program (WRP) is under contract to the Oregon Department of Environmental Quality (DEQ) to prepare a Vegetation Management Strategy, Planting Plan, and Vegetation Maintenance and Monitoring Plan for the McCormick and Baxter project area in Portland Oregon. The purpose of this document is to present a strategy for the management of the vegetation that meets or exceeds the project goals for the vegetation component.

This document describes a management strategy for grading of the bank from elevation 14.6 (NGVD) to elevation 30 (NGVD), from Willamette Cove to station 27+00, soil preparation requirements and suggestions, plant species selection, habitat specific planting zones, planting means and methods, and means and methods for ensuring the long term success of the vegetation. Specific guidelines for development of this strategy come from: *Sediment Cap Basis of Design McCormick & Baxter Creosoting Company* (Ecology and Environment Inc 2002): the city of Portland's *Willamette Riverbank Design Notebook,* Draft (2000): *Design Recommendations for Riparian Corridors and Vegetated Buffer Strips* (Fischer and Fischenich 2000), City of Portland Sediment and Erosion Control Requirements, the City of Portland Storm Water Manual, and staff scientists expertise and experience.

2. Site Description

Landscape Setting

<u>Existing</u>

The site is located on the east bank of the lower Willamette River watershed at river mile 7.0, between St Johns Bridge and Swan Island. The portion of the site that will be addressed in this document extends from Willamette Cove to approximately station 27+00. The area from Willamette Cove to approximately station 10+00, elevation 14.6 to 16.6 is addressed in this document as is the area included within station 10+00 to station 27+00, elevation 14.6 to elevation 30.0 (NGVD). The site is within the periodic floodplain. Elevation of the bi-annual event is (14.5 NGVD), elevation of the ten year event is 18.7 (NGVD) and the elevation of the 100 year event is 26.4 (NGVD). Ordinary low water is 1.7 (NGVD) and ordinary high water is 16.6 (NGVD). The width of the project area is approximately 60 to 70 feet. There is minimal connectivity to a comprised riparian community on the project's north boundary. There is no linkage between the project area and aquatic habitat.

<u>Future</u>

The project area is proposed to become part of a future greenway, with the possibility of recreational fields adjacent to the greenway. Opportunities exist to expand the project area to the south and to the east, to create a larger more effective riparian buffer and increase habitat connectivity.

Hydrology

Existing

Sources of water for the project area are precipitation, flows in the Willamette River, the associated ground water table, and some limited surface flows. The average annual precipitation for the site is 41.1 ". (COP Rainfall data Collection Gauge at the WPCL for 1977- 2002) The majority of the precipitation falls, on average, between October 15 and July 5.

Future

No changes are anticipated to the hydrology from the existing hydrology as a result of this project or the proposed greenway.

Soils

Existing

The Soil Survey of Multnomah County (Soil Conservation Service, 1983), classified these soils originally in this area as gravelly loam, silt loam, or silty clay loam with some sandy materials. Visual analysis of the existing soils on the project area consist of unconsolidated sands with little to no binders, gravels, silts, clays or organic materials. They appear to be primarily a mineral composition with little to no organic content, essentially unconsolidated sands. Soils at elevations more than 1 foot above water level, (typically wicking height of soil) will be droughty.

Future

The current plan calls for a bank layback to preserve the integrity of the sediment cap from approximately 15 (NGVD) to 30 (NGVD)(station 10+00 to 27+00) and new fill and topsoil to be imported to the project area. Specifically, the plan also calls for placement of 2' feet of clean fill on the banks above 15 (NGVD), and the installation of a turf reinforcement mat (TRM) over the fill, coupled with vegetation for permanent erosion control protection.

Recommendations

According to representatives from the manufacturer of a TRM, American Excelsior Company (AEC), the soils underneath do not have to be compacted or placed as an engineered fill. Also, the representative from AEC suggests that since the fill is not engineered that we consider adding an additional product such as "Curlex II" to the lower portion of the slope. This product, or other similar products that biodegrade after two years, will provide additional protection against erosive forces associated with wave action or current until the soil is stabilized through root growth of the plants. We recommend that a product with similar performance properties be applied in addition to the TRM from the intersection of the ACB to 18.7 (NGVD).

The source of this new fill is critical in that it should be representative of the soils found historically in floodplains of the lower Willamette. The clean fill should be of a similar composition, mineral verses organic content, and soil classification as the historic soils for establishment of vegetation and to ensure that the erosive potential of the soils on the bank has not been increased.

Finally, where it is possible, the depth of the clean fill should be vary from a minimum of 2' to 4' from the intersection of the ACB/TRM to 19.7 (NGVD). This variation of fill depth will provide opportunities to increase the complexity of the bank. In areas where there is 4' of clean fill root wads/logs salvaged from the project area may be installed. The 4' feet of clean fill will allow the burial of a portion of the log, up to 20" diameter, without disturbing the contaminated media. Numerous, 20 to 30 logs could be placed with the roots providing aquatic micro habitats during high water events. The logs could be placed between just above the ACB/TRM intersection up to 18.7 (NGVD).

Aspect

Existing

The existing slope of the project area is approximately 7:1 up to elevation 15+/- (NGVD). Above 15 (NGVD) the slope increases to 3:1 to 1.5:1. The project area, from approximately station 10+00 to 27+00, has a southwest exposure and is exposed to full sun through the day. From station 10+00 to Willamette Cove the project area has a west transitioning to a north exposure on the north side of the rail line. There are no natural sources of shade, except for a short stretch under the rail bridge. Drainage of the project area is very good. The soils are highly porous and permeable. Surface runoff will be minimal to non-existent under most rain events. The soils more than 12" above the water surface elevation of the Willamette River will typically be dry during the period of July 5th to October 15th.

Future

The proposed grading for the project area will create a bench, with a 2% slope, at elevation 20 (NGVD) of a constant width of 15', and slopes with a constant grade of 3:1 from the intersection of the ACB/TRM to 30 (NGVD).

Recommendations

Opportunities for increasing the complexity of slope exist but will have impacts on the cost of the project. Where possible, we suggest that the re-grading of the bank incorporate a terrace whose width & elevation vary for added complexity. The elevation of the terrace vary should from 17.7' to 19.7' (NGVD) and the width should vary from 12' to 18' feet. We also propose that the slope below the terrace is flattened to 6:1, but varies from 7:1 to 5:1. The slope above the terrace could vary from 4:1 to 6:1. This proposed grading of the bank will result in an environment with more complexity (a slightly undulating shoreline with varying slopes and terrace elevations) and add to the diversity of habitat. Due to proximity of contaminants associated with the Wooden Bulkhead and Interceptor Trench, the bank slope of 3:1should be maintained from approximately station 12+61 to 19+91.

We also see an opportunity to create a buffer zone for wildlife. We suggest that the width of the project be expanded to a minimum of 40 meters from station 10+00 to 27+00. The width of the proposed terrace and slope is approximately 60 to 70'. This width is sufficient for a buffer zone where water quality from surface runoff is a concern, but it is not wide enough to function as a vegetated buffer strip for reptiles, amphibians, mammals, fish or invertebrates. In general for invertebrates, fish, reptiles and amphibians, the strip needs to be at least 30 meters wide. For mammals it should be a least 50 meters wide, and for birds it should be at least 40 meters wide. *Design Recommendations for Riparian Corridors and Vegetated Buffer Strips* (Fischer and Fischenich 2000).

Functions

Existing

Plants on the project area are generally situated between, elevation 15 and 30 (NGVD). The species on project area is representative of a compromised riparian community consisting of Scots Broom, weedy grasses, Cottonwoods, Clematis, Himalayan Blackberry. The project area lacks complexity and diversity in the understory, and lacks canopy from station 17 +00 to station 27+00. The project area has no edge or height diversity in a native plant community. Minimal height diversity exists in the invasive weeds on project area. Edge habitat to the east, south and north is highly comprised composed of weedy grasses, Himalayan Blackberry and Scots Broom. Existing conditions of the project area add little to no value to buffering. The existing weedy plant community is sparse, has little impact on stormwater runoff quality, and is not large or wide enough to function as habitat for a variety.of plants or animals. Existing vegetation does little to prevent erosion by wave action or surface run-off.

Future

The project area has potential for providing a vegetated buffer strip for reptiles, amphibians, mammals, invertebrates and birds. The project area will be planted with a diverse mix of native trees, shrubs and grasses to mimic a forest found on the banks of the Willamette in an early successional stage. The ability of this project area to function as a buffer strip for wildlife could be impacted by the implementation of the greenway on the adjacent property.

Recommendations

The native plant community installed on the project area should be comprised of the native species and densities specified in the attached Plant List. The combination of these plants will provide diversity in the native plant community. They will also provide habitat and food for animals such as California Quail, mourning dove, wintering waterfowl, skunks, raccoon, opossum, rabbits, mice, foxes, hawks, owls crows, flycatchers, shorebirds and larks. Use of the native herbaceous plants proposed will improve project area edge and height diversity and storm water filtering over that of non-native weedy vegetation (*Storm Summary Report WPCL Bioswale Monitoring Fiscal Year 2001-2002,* City of Portland, Water Pollution Control Laboratory, 2002). The combination of native overstory and shrubs will reduce the energy associated with rain impact on the soil, and the herbaceous layer will add to soil stability by binding soil particles together through their fibrous root systems.

The current proposal for the placement of the Articulated Concrete Block (ACB) in the water will provide little opportunity for complexity and aquatic habitat. Complexity may be increased if the finished grade of the ACB includes undulations. These surface undulations could be both depressions and mounds would increase the in-water complexity. The slopes of the undulations should not exceed 7:1, the size and footprint of them should be variable.

3. Project Vegetation Goals, Objectives and Performance Standards

Goals

- Increase habitat complexity of the site.
- Provide height diversity, edge habitat.
- Enhance erosion control capability of the project area and enhance soil stability characteristics.
- Improve quality of storm water runoff.
- Provide means for capture of woody debris and adding to the shore complexity.
- Improve ecological health and bio-diversity by controlling exotic invasive plant species.
- Improve habitat for nesting waterfowl and migratory shorebirds.

Objectives

- Install two vegetation community habitats, upper riparian and lower riparian.
    - Upper riparian species will include eleven species of trees and large shrubs, eight species of small shrubs and eight species of herbaceous plants.
    - Lower riparian will include three species of trees and large shrubs, nine species of shrubs, and eight species of herbaceous plants.
- Control invasive weeds through adaptive vegetation management strategies.
- Vary slope of the bank, both above the terrace (4:1 to 6:1) and below the terrace (5:1 to 7:1). Vary the width of the terrace from 12 to 18 feet.
- Vary the depth of fill from 2 to 4'.
- Salvage woody debris on site for reuse.

Performance Standards

- Upper Riparian (18.7 to 30.0 (NGVD))
    - Plant 820 trees and 820 shrubs per acre, species as identified on the Plant list.
    - 80% survival of upper riparian species after one year, in a year of normal precipitation.
    - Seed applied at the rate of 35 pounds per acre. Seed mix composed of species listed on the Plant list.
    - Invasive weed species represent less than 10% of plants in the project area after five years.
    - A minimum of eleven species of native large trees and shrubs on site after five years. No single species exceeds 50% of the total stem count.
    - A minimum of eight species of shrubs on site after five years.
    - A minimum of eight species of herbaceous plants on site after five years.
    - 80% herbaceous and shrub cover after five years.
    - 30% Canopy closure after five years.
    - Install large salvaged woody debris in the re-graded bank from 18.7 to 19.7 (NGVD)
- Lower Riparian (16.6 to 18.7 (NGVD))
    - Plant 540 trees and 1100 shrubs per acre, species as identified on the Plant list.
    - Trees shall be planted no lower than 17.7, or the river-side edge of the terrace.

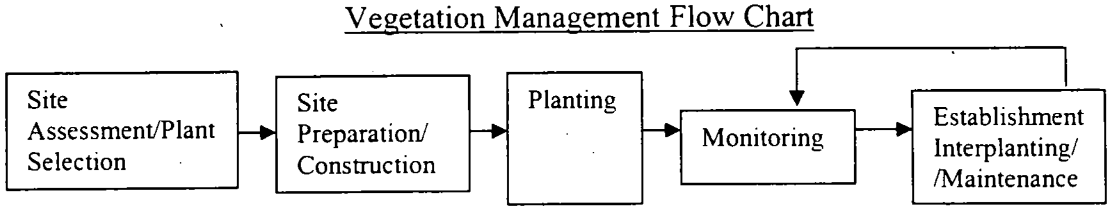
    - Seed applied at the rate of 35 pounds per acre from elevation 16.6 to 18.7. (NGVD) and 10 pounds per acre in the ACB. Seed mix composed of species listed on the Plant list.
    - 80% survival of lower riparian species after one year, in a year of normal precipitation
    - Invasive weed species represent less than 10% of plants in the project area after five years.
    - A minimum of three species of native large trees and shrubs on site after five years. No one species is more than 50% of total stem count.
    - A minimum of nine species of native shrubs on site after five years.
    - A minimum of eight species of herbaceous plants on site after five years.
    - 80% herbaceous ground cover after five years above 16.6 (NGVD).
    - 30% Canopy closure after five years.
    - Install large salvaged woody debris in the re-graded bank from 16.6 to 19.7 (NGVD)
- <u>ACB (14.6 to 16.6 (NGVD))</u>
    - Seed, species as stated on the plant list, applied at the rate of 10 pounds per acre

4. Installation, Establishment Strategy
Phase I – Year 1 through 5

The strategy for vegetation management for this project proposes tools and methods that will restore a diverse native plant community with a variety of appropriate species that will improve aspects of habitat functionality. The vegetation management strategy proposed is based on the principles of sustainability, with the utmost consideration for restoration of the native environment, the life cycle cost of the design, and social equity.

Installation of vegetation on this project will require the coordinated efforts of all stakeholders to ensure that the treatments are properly applied and are timely. These treatments include site preparation, grading, seeding, erosion control, planting, animal damage protection, and maintenance tasks. While some tasks can and do occur throughout the year, most are seasonal and must be accomplished on a fixed schedule to meet biological, economic, and sequential requirements. The following plan describes the scope and timing of the major treatment types that will be applied to this project. When accomplished according to schedule, these treatments will provide the highest likelihood of success on this project.

<u>Vegetation Management Flow Chart</u>



Integrated Vegetative Management Approach to Revegetation

After years of using non-chemical techniques to control invasive vegetation with very limited success, WRP is now using highly targeted application of chemical controls in combination with physical and cultural controls. The use of chemicals as a tool against the invasive species allows for the successful, cost effective re-introduction of the native understory (shrubs, herbs and grasses) within a few years of a projects initiation. The re-introduction of the herbaceous layer makes for a full spectrum of native plant species re-introduction. A healthy herbaceous layer also discourages the rate of spread of invasive species and provides local on-site natural erosion control. By covering the ground they help keep foreign weeds from re-invading, reducing the need for additional or chemical treatments. The approach utilized by the Revegetation Program is consistent with the Bureau's Draft Vegetation Management Policy, and City of Portland Parks Integrated Pest Management Plan.

Permitting

The revegetation of the project area will comply with Title 33.440.350 Approval Criteria. All proposed revegetation activities will comply with current Greenway zoning approval criteria.

Site Assessment

Site assessment should be done by botanical scientists to document weed problems that will hinder the establishment of a native plant community at the project area. Since this project will be primarily a constructed site, it is expected that there will little to no existing invasive weeds remaining. At the completion of grading activities for the clean fill and placement of the TRM, a revegetation expert should assess the extent of invasives remaining on the site to determine if any additional site preparation techniques will need to be done prior to planting the site.

Site Preparation

Site preparation activities may include mowing, cutting and herbicide application, or combination of these tools to prepare the project area for the installation of native plant materials by removal of invasive weeds. Again this will be a constructed site and the extent of site preparation activities is expected to be minimal.

These treatments are tailored to the project area, and adhere to the guidelines of the City of Portland's Watershed Revegetation Programs Weed Management Plan. The purpose of site preparation is to improve initial growing conditions for native plantings, provide access to the planting sites and provides open initial growing conditions for planted seedlings.

Weed Management Plan

Prevention is an easy, cost-effective and important part of noxious weed control. By observing good land management practices the project area may realize a reduction in the invasion of noxious weeds. Examples of prevention techniques are:

- Monitoring sites for new weed infestations and addressing them before they spread;
- Purchasing only weed-free seed and straw

- Minimizing soil disturbances on site
- Addressing erosion control issues immediately
- Tilling or sub-soiling compacted soil on construction sites
- Covering all disturbed soil immediately with native herbaceous seed and/or straw
- Maintaining and restocking native vegetation as needed to withstand invasive weed invasion.

Physical Control

Physical control involves the use of hand or mechanical equipment to combat weed infestations.

Manual Removal – is the removal of part or all of weed by hand or with hand tools. Manual removal is practical only on small isolated patches of weeds and is more effective on perennials and weeds that do not have advantageous roots. This method must be followed up with monitoring and additional manual removal or other weed management methods. Disadvantages of this method include: soil disruptions, timeliness and high costs.

Mechanical Removal uses mowing or cutting to help control weeds by preventing seed production or by depleting roots by repetitive application. Mowing and cutting work best in conjunction with other weed management methods because repetitive application is disruptive to the soil, disturb local fauna, contribute to noise and air pollution and are not effective on some exotic weeds. Mowing or cutting in conjunction with chemical controls can lower the amount of herbicide used, by lowering the amount of surface area that must be targeted and by creating better access to target weeds, thereby reducing overspray. Mowing uses machinery to cut vegetation and is not an option on sites were there are a lot of trees and shrubs, on rough or steep terrain, or where natives are intermixed with exotic species. Cutting uses power saws, brush cutters and/or machetes to cut plants, while leaving the roots intact. Cutting has similar effect as mowing, but can be used in situations where mowing is unpractical.

Cultural Control

Cultural controls are land management practices aimed at preventing the spread or establishment of invasive weeds. Examples of cultural control methods are:

- Dense planting of native trees and shrubs to increase shade
- Seeding all disturbed or open ground with native seed mixture appropriate to the site.
- Planting and encouraging desirable vegetation.

Chemical Control

Chemical control involves the use of herbicides to manage invasive weeds on project sites in conjunction with other cultural, manual, mechanical and biological techniques. Herbicides are seen as a transitional tool to help enable the suppression of weeds and replace them with desirable, competitive native vegetation. Only the least toxic and low-residual herbicide that is effective against the target weed will be selected and applied in a judicious manner.

Recommendation

Mechanical removal, specifically cutting, in combination with highly targeted herbicide application and cultural controls, is the recommended invasive weed treatment for the project area. The combination of these three tools has proven to be an effective approach to dealing with invasive weeds on sites with weed seed sources close by and this approach is sustainable. The Dense plantings of native trees, shrubs, and seeding with grasses and flowering forbs will discourage the return of invasive weeds.

Due to the high cost of removal, and potential disruption of the clean fill, manual removal for the control of weeds is not recommended for the project area.

Application

Herbicides will be applied at the project site where invasive weeds are hindering or will hinder the establishment of the native plant community. Application will be done by licensed herbicide contractors and supervised by licensed city staff scientists.

Licensed herbicide contractors will apply specified herbicide to target weeds using backpack sprayers. Backpack sprayers will be used to spot-apply herbicide to weeds.

Weather conditions will be considered before deciding to apply herbicide. Herbicide will not be applied under any wind conditions greater than 6 mph. Herbicide applicators will use a spray shield, coarse spray nozzle, or drift retardant to eliminate drift. No herbicide drift or over-spray will be allowed on native vegetation. Native plantings will be protected with portable metal plant shields during all herbicide applications.

Compliance

All herbicide will be applied by a licensed herbicide applicator in accordance with the following regulatory agency guidelines.

- EPA – All herbicide will be handled, applied and stored in accordance with EPA labeling directions.
- ODA
- DEQ
- OR-OSHA
- NMFS – Will use Portland Parks Waterway Management Policy

Chemicals

The following chemicals and chemical formulations shall be used for weed control on the project area.

Herbicides

Chemical	**Trade Name**
Glyphosate	Round-up, Round-up Pro, Rodeo

Surfactants

Chemical	**Trade Name**
Phosphatidylcholine, methylacetic acid and alkyl poloxyethylene eher	LI-700

Carriers

Water

WEB Oil

Target Weeds

The following is a list of some of the most prevalent weed species in the Portland Metro area that hinder the establishment of a native plant communities and the herbicides that are effective on them.

Latin Name	Common Name	Herbicide	Application Type	Vegetation State
Cirsium arvense	Canada Thistle	Glyphosate	Spot	Active growing after bud growth stage
Cirsium vulgare	Bull Thistle	Glyphosate	Spot	Active growing after bud growth stage
Clematis vitalba	Clematis	Glyphosate	Spot	Active growing
Conium maculatum	Poison Hemlock		Spot	Active growing
Convolvulus sepium	Morning Glory, Hedge Bindweed	Glyphosate	Spot	Flowering
Hedra helix	English Ivy	Glyphosate and Pelargonic Acid	Spot	
Phalaris arundinacea	Reed Canary Grass	Glyphosate	Spot	Regrowth after cutting or 1-3ft above ground
Rubus discolor	Himalayan Blackberry	Glyphosate	Spot	Regrowth after cutting or 1-3ft above ground
Solanum dulcamara	Purple Nightshade	Glyphosate	spot	Active growing

Site Grading & Erosion Control

At the conclusion of grading the terrace, the spreading of native seed, installation of the TRM and coir mat should be a completed as a time sensitive, continuous operation. A bio-degradable erosion control mat is recommended for placement under the TRM from the toe of the TRM (14.6 NGVD) to elevation 16.6 (NGVD). The purpose for the mat is to protect against sediment movement from the slope beneath the terrace to the river. The sediment under the TRM will not be an engineered fill, it will not be compacted and highly susceptible to sediment transport by runoff. The coir mat will provide additional sediment trapping capability to the TRM until plant have established and the root systems matured providing additional soil stability.

Seeding

Seeding should occur immediately following completion of final grading of the terrace and prior to the placement of the TRM and any other erosion control mat. Seeding with native grasses and forbs reduces erosion from excavated and cleared sites and covers the ground greatly reducing re-invasion of the site by weeds. As a preventive measure for weed control, seeding is a major component to integrated vegetation management. Seeding also rapidly produces a diversity of vegetation and habitat for native wildlife. Seeding typically occurs in late summer and fall.

Seeding performs two critical functions and will be applied to the project immediately post grading and the second seeding will occur in year four or five.

- Primary purpose of the first seeding, post grading, is for erosion control, weed displacement and the initial re-introduction of native grasses and forbs for improvement of habitat functional values. Species are selected for their ability to compete with invasives, the displacement of broadleaf herbaceous weeds, growth rates, soil stability characteristics, caespitose or bunch grasses with fiberous root masses and rhizomatous plants that send out runners to provide additional groundcover.

- The second seed application will occur in the projects fourth, or fifth year depending on the condition of the vegetation on the site. Seeding that is performed at this time is typically not for erosion control purposes. It is to reintroduce a more varied mix of native grasses and forbs that were not included in the initial seed application completed earlier in the projects life because of the ability of the specific species of grasses and forbs to succeed in the current environment of the site and their cost. Species selected for this application are identified by scientists with a through knowledge of early stages of successional development of a disturbed forest.

Initial Planting and Interplanting

The planting for this project is designed to restore the function of native and natural habitats. It is also designed to establish over time, a canopy of native trees, an understory consisting of shrubs, forbs, herbs and other plants while at the same time keeping short and long term maintenance costs at a minimum. The design of this planting is based on the principles of sustainability, with the utmost consideration for restoration of the native environment, the life cycle cost of the design, and social equity. The planting scheme for this project calls for the installation of plant materials in rows. This scheme lends itself to reduced costs for installation, reduced costs for maintenance, and increased ease of monitoring the project area. Planting in rows will not adversely impact quality of the restored habitat, but it will increase the ease of performing establishment and maintenance that in turn translate into a project with increased chances for success. This methodology alternates tree, shrub and species of tree and shrub within the rows. It is not a landscaped installation. Planting the site in rows will not look natural initially when viewed from certain directions, but over time the rows will not be discernable due to growth of plants and native volunteers sprouting at random locations.

Means and methods:

- Initial planting of the site should occur after the completion of site preparation and grading activities.
- Initial planting should occur between January 1st and March 30th.
- Bare-root stock should be utilized, plugs may also be utilized.
  - Planting occurs in rows that are spaced from five feet (plants 5.3' feet on center) to eleven feet, (plants on 2.2' on center), alternating tree and shrub.
  - Plant spacing may vary over the site as determined by invasive species management methodologies.
  - Planting density will be 1640 plants/acre. This may vary depending on the number of existing natives on the site, topography of the site, and soil conditions.
- Interplanting a site with trees should occur if the less than 80% of the trees and shrubs installed in the initial planting did not survive the first year.
  - Interplanting plugs (small containerized plants) are desirable for propagating certain species of wetland plants and upland forbs that are not adaptable to other methods. Plugs are installed in the fall and spring.
  - Interplanting occurs in patterns similar to the original planting.
  - Interplanting density will be determined by plant mortality rate on the site. Quantity of plants is determined by percent loss of the original planting of 1640 plants/acre. This may vary depending on the number of existing natives on the site, topography of the site, soil conditions.

Animal Damage Protection
Herbivorous animals are a major influence on vegetation in natural areas and may pose a problem on this site. Beaver, deer, nutria, voles, and other rodents can rapidly eliminate tender young trees and shrubs over large areas. To reduce these losses, animal damage protection devices such as photo-degradable vexar tubes or plastic mouse-deterring mesh should be installed around newly planted seedlings. Devices used should be adapted to the type of anticipated damage.

Site Establishment
Site establishment and maintenance activities involve managing the invasive plants on the project site. Invasive plants are managed to not adversely affect the survival rate and growth of the native plantings and should be kept to less than 10% of plants on the site. Activities involved in managing invasives may include cutting, mowing and targeted spot spraying the invasive plants. Establishment activities occur for two years after each phase of planting (initial and interplanting) and maintenance activities occur for the two years following establishment period. Both establishment and maintenance activities occur throughout the year, but are generally concentrated in spring and summer months.

Monitoring
The purpose of all monitoring is to collect data to provide information from which decisions will be made about treatments necessary to achieve project success as outlined in 'success criteria' sections. All data collected is used to determine application of future treatments such as; cutting or herbicide application targeting non-native weeds, planting to assure adequate plant density and species selection and diversity, or treatments of spot specific problems such as erosion control. This protocol and format should be used to assess conditions and trends on the project.

Goals
- Define a systematic schedule for data collection, analysis, and feedback to be used in the prescription of future vegetative management tasks by the site manager.

Objectives
- Collect data through regular, periodic site visits to gauge the success of vegetation and applied vegetation management treatments.
- Ensure success of the project vegetation and vegetative erosion control measures.
- Identify vegetation or erosion issues early on and address them before they become problematic, widespread, or costly to resolve.
- Ensure compliance with permit requirements and contractual specifications for vegetation management.

Monitoring Schedule & Methods
Distinct vegetation types within project sites are stratified and surveyed separately using the methods outlined below. This project has three planting zones, the first from elevation 14.6 to 16.6, the second from elevation 16.6 to 18.7 and the third from elevation 18.7 to elevation 30 (all elevations in NGVD). The three planting

zones combine woody plants and herbaceous plant materials with the lower zone entirely herbaceous, and the second and third zones comprised of a mixture of herbaceous and woody plant materials.

Monitoring for woody plant survival is performed annually for a period of ten years, with more intensive data collection occurring in years one, five and ten (Formal & Informal Woody Plant Monitoring and Herbaceous Seed Monitoring). Monitoring for non-native weed control is performed a minimum of three times annually, during the growing season (Vegetation Management Monitoring).

Formal Woody Plant Monitoring
Formal project monitoring shall be conducted in the fall in the year following initial planting and year five and year ten (if it is a ten year project) of the project. The resulting report documents stocking rates and conditions of native woody plantings, non-native weeds, and general herbaceous information.

For species composition evaluation, the minimum sample size is five percent of the total area (or five 1/100th acre plots per acre).

On project sites age 1 to 4
On project sites up to four years old, surveyors collect data in 11.7-foot-radius (1/100-acre) circular "target" (single-tree) plots. Plots may be circular (11.7 -foot-radius) or semi-circular (16.8-foot-radius) as best fits the area being monitored. All woody plants in each plot, whether planted or natural, are identified by species, counted, and assessed for plant vigor. Other observations include plant mortality and causes, animal activity, and any other significant natural resource observations.

Total tree canopy and native shrub cover is estimated to the nearest tenth percentage from each 1/100-acre plot center using ocular estimates.

Herbaceous vegetation cover is estimated to the nearest tenth percentage of plot occupied by species identified. If native herbaceous vegetation is significant in extent, it is monitored according to the guidelines for herbaceous vegetation monitoring (see Herbaceous Vegetation Monitoring section).

A running list of all species identified at the site is recorded.

On project sites age 5 to 10
Native woody plants are counted as described above. Additions to measurements include diameter at breast height (DBH), when applicable, and percent canopy using a densiometer. Four densiometer measurements are taken, each at 4.5 feet above plot center facing north, east, south, and west. The average measurement is recorded. Monitoring occurs during summer/early fall months when hardwoods are fully leafed out and winds are mild, less than 10-mph winds. Native shrub cover and herbaceous vegetation cover are measured using ocular estimates as described above.

Informal Woody Plant Monitoring
Informal monitoring shall occur on this project in all years, years 2 through 4, 6, 8, and 9. Data collection includes: native tree and shrub per acre counts; native and non-native weed species cover to the nearest tenth percent; list of native and non-native species present at the site; general natural resource observations; and prescribed maintenance treatments.

Herbaceous Vegetation Monitoring: Seeded Sites Years 1 through 10
Formal herbaceous monitoring occurs in years one and five, seven and ten and is performed during June and July. Herbaceous vegetation is monitored using one-meter square, directed-random sample plots and sampled at a rate of five plots per acre with a minimum sample size of ten plots on sites one to five acres in size. When herbaceous vegetation occupies more than 10 percent of the ground, it is identified using ocular estimates and estimated to the nearest tenth percent. All species cover under 10 percent is identified and recorded as present on the plot. The resulting Herbaceous Monitoring Report documents the successes and failures of native upland seeding and summarizes percent cover results.

DATA ANALYSIS

Most data analysis is simple calculation of means and extrapolation of plot means to generate per-unit area averages.

Example: where: Planted TPA = planted trees per acre
T = total of trees found on all plots
n = total number of plots
A = area of plot in acres

Then: Planted TPA = T/nA

Survival percentages are calculated as the proportion of surviving *planted* trees or shrubs on plots divided by the total number of trees or shrubs originally planted on plots.

Vegetation Management Monitoring
Vegetation Management monitoring will take place three times per year during the spring, summer, and fall of each year. Vegetation Management monitoring recommends treatments in response to specific non-native weed problems at each project site. These recommendations are directly entered into the program database for implementation.

Possible recommended treatments include:

- Planting
    - Recommend planting type
        - Initial planting
        - Interplanting

Estimate number of plants
Recommend species mixture

- Seeding
  Recommend species mixture
  Estimate acres to be seeded
- Watering
- Tube maintenance
- Animal damage control
  Identify target plant and animal species
  Recommend beaver guards, mouse mesh, or other
- Competing vegetation control
  Identify target non-native species
  Recommend manual cutting, mowing, mulching, scalping, herbicide (type), other

Each treatment recommendation should include a recommended treatment date, total treatment acreage, and a priority rating of high, medium or low. Priority is based on immediacy of the problem or opportunity, cost of treatment, and anticipated benefits of the treatment. The following examples illustrate different priorities.

High - Example: A newly planted stand of trees is being overtopped by Himalayan blackberry. Cutting releases young trees from competition for light. Immediate treatment averts losses of valuable plants.

Example: An area of disturbed soil along Johnson Creek could be planted with pole cuttings at low cost. Immediate treatment will capitalize on an opportunity.

Medium - Example: A long reach of the Columbia Slough has a stand of Himalayan blackberry and no trees on the south bank. Treatment has great long-term potential water quality benefits, but benefits are only marginally greater now than later.

Example: A three-year-old stand of cottonwood and willow averages 15 feet tall. Resprouting Himalayan blackberry is clambering into trees, reducing growth, and threatening survival of some smaller trees. Cutting blackberry will improve stand growth and prevent some mortality.

Low - Example: A stand of mature cottonwoods has an understory of Himalayan blackberry. Grubbing blackberry and planting snowberry and elderberry could increase diversity and appearance of the stand.

Example: Four acres of upland in Tryon Creek watershed has a dense stand of ancient Himalayan blackberry and Scotch broom. The area could be converted to more desirable vegetation, but costs are high, water quality benefits are relatively small, and timing is not critical.

Data Recording and Information Storage

The project manager shall be responsible for updating project site maps and placeing all plot cards, data summaries, reports, and other pertinent information in a folder established for the project.

Photomonitoring Protocol
(per OWEB *Photo Plots: A guide to establishing points and taking photographs to monitor watershed management projects*)

Taking photographs is one of the most basic monitoring techniques. While photographs cannot tell the entire story about a project, much information can be gathered from photographs taken at the same point over a number of years. Please refer to OWEB manual for specific diagrams and schematics.

Equipment:
Digital camera (always used fully zoomed out to widest angle)
Photo identification label and post to be in photograph

Two types of photographs:
General view (features and landscapes)
Close-up

General View
This type of photo is shall be used for this project. General view photos can be divided into two categories:

- Feature
- Landscape.

Feature photos document change on or around larger objects such as rock dams, streambanks or stream profiles. Pictures can be taken with views across, upstream and/or downstream (showing, for example, changes in a stream profile), or across or up and down a fence line to show contrast between different land management activities.

Feature photos are usually taken from opposite ends of an imaginary line. For example, you may set up a photo plot to monitor changes on opposite sides of a stream. To do this, drive a stake or post into the ground on each side of the stream. The two points should be about 30 or 40 feet apart. Place the photo identification label in an upright position so that it appears in the foreground of the photograph. Holding the camera over one stake, center the other stake in the middle of the photograph. For the next photo, reverse the procedure. Be sure to include the photo label and, if possible, some sky I the photo to help set the scale of the objects being photographed.

Landscape photos are an overview of the area showing the feature and its relationship to the surrounding area. A landscape photo might be taken from a nearby hill showing from a distance the same section of stream where the feature photo was taken.

Mark photo point location and direction (important!) of picture on photo point layer in GIS program so that same photo point can be found in subsequent years. If you think the exact photo point location will be difficult to find in subsequent years, you could also leave a brightly painted stake to mark the spot.

The process for subsequent photographs should be the same process used in taking the initial ones. Match up the same landmarks and stakes in the subsequent general view photos. Photographs shall be labeled.

Close-Up Photographs

- Close-up photos show specific characteristics of an area, such, soil surface, or the amount of ground surface covered by vegetation and organic litter. Close-up photos are taken from permanently located photo points.

- Usually a one meter square area is used for close-up photo plots. To mark the corners of the square, drive angle iron or rebar stakes into the ground on all four corners. Paint the stakes a bright color, such as yellow or orange, ot help you relocate them during subsequent picture taking.

- Always keep the lens zoomed out to widest angle.

- You and your camera should stand on the north side of the plot. By standing on the north side, photographs can be taken at any time during the day without casting a shadow across the plot.

- Before taking the picture, place a filled-out photo identification label on ;the ground next to the photo plot.

- Place a measuring tape across the south side of the plot. The tape should be opened to 36 inches with the tape reading from left to right. The tape will provide some relative scale to the photo. Stand about six to eight feet back from the center of the plot. Be sure you can see the label in the camera view finder.

- After taking the picture, mark the location of the photo plot on the map along with an arrow showing the direction in which you took the photo.

Phase II: Long term Vegetation Management

Long-term maintenance evaluation

The long-term success of the site will be dependent on many factors. Factors such as:

- The level and frequency of flood events in the Willamette.
- Long term aggregate effects of annual precipitation amounts.
- The extent of continual re-introduction of invasive weeds by air, water and animals.
- Development of adjacent sites.

Of these factors, the one that we may have an impact on is the re-introduction of invasive species to the site. At the end of five years, the project manager should evaluate the fifth year monitoring data to identify anticipated long-term maintenance needs of the site. Long-term maintenance needs may include:

- Continued weed management through the use of tools such as cutting and herbicide.
- Additional plantings with natives may be required in areas that were slow to establish, were damaged by floods, failed due to animal damage, or fire.
- Additional seeding with native grasses that failed due to flooding or invasive species domination.
- Additional seeding with shade tolerant or finer species of grasses due to the increased canopy of the site.

McCormick & Baxter Planting Recommendations

Upper Riparian (18.7 to 30.0 NGVD)

Shrub species	Common Name	820 Shrubs/acre	Plant Type
Berberis aquifolium	Tall Oregon Grape	20%	BR
Rosa nutkana	Nootka Rose	20%	BR
Symphoricarpos albus	Snowberry	20%	BR
Ribes sanguineum	Red flowering current	15%	BR
Holodiscus discolor	Oceanspray	10%	BR
Cornus sericea	Red Osier Dogwood	5%	BR
Lonicera involucrata	Twinberry	5%	BR
Physocarpus capitatus	Ninebark	5%	BR

Tree & Large Shrub species	Common Name	820 Trees/acre	Plant Type
Alnus rubra	Red Alder	20%	BR
Fraxinus latifolia	Oregon ash	20%	BR
Crataegus suksdorfii	Black Hawthorn	10%	BR
Rhamnus purshiana	Cascara	10%	BR
Sambucus racemosa	Red Elderberry	10%	BR
Acer macrophyllum	Big-leaf Maple	5%	BR
Thuja plicata	Western Red Cedar	5%	BR
Arbutus menziesii	Madrone	5%	BR
Abies grandis	Grand fir	5%	BR
Quercus garryana	Garry Oak	5%	BR
Sambucus cerulea	Blue Elderberry	5%	BR

Herbaceous species	Common Name	35 Lbs./acre	Plant Type
Bromus carinatus	California brome	12	seed
Elymus glaucus	Blue wildrye	10	seed
Hordeum brachyantherum	Meadow barley	4	seed
Deschampsia elongata	Slender hairgrass	2	seed
Agrostis exerata	Spike bentgrass	1	seed
Gilia capitata	Globe gilia	2	seed
Lupinus albicaulis	Lupine	4	seed
Solidago canadensis	Canada goldenrod	0.25	seed

Lower Riparian (16.6 to 18.7 NGVD)

Shrub species	Common Name	1100 Shrubs/acre (50% BR/50%LS)	Plant Type
Spiraea douglasii	Hardhack	25%	BR
Cornus sericea	Red-osier dogwood	25%	BR, LS
Physocarpus capitatus	Ninebark	10%	BR
Rosa pisocarpa	Swamp rose	10%	BR
Salix fluviatilis	River willow	10%	LS
Salix sitchensis	Sitka willow	5%	LS
Salix rigida	Rigid willow	5%	LS
Salix piperi	Piper's willow	5%	LS
Lonicera involucrata	Twinberry	5%	BR

Tree & Large Shrub species	Common Name	540 Trees/acre	Plant Type
***Fraxinus latifolia*	Oregon ash	33%	BR
***Crataegus suksdorfii*	Black Hawthorn	33%	BR

***Rhamnus purshiana*	Cascara	33%	BR

Herbaceous species	Common Name	35 Lbs./acre	Plant Type
Bromus carinatus	California brome	12	seed
Elymus glaucus	Blue wildrye	10	seed
Hordeum brachyantherum	Meadow barley	4	seed
Deschampsia elongata	Slender hairgrass	2	seed
Agrostis exerata	Spike bentgrass	1	seed
Gilia capitata	Globe gilia	2	seed
Lupinus albicaulis	Lupine	4	seed
Solidago canadensis	Canada goldenrod	0.25	seed

ACB (14.6 to 16.6 NGVD)

Herbaceous species	Common Name	10 Lbs./acre	Plant Type
Deschampsia elongata	Slender hairgrass	2	seed
Deschampsia caespitosa	Tufted hairgrass	2	seed
Agrostis exerata	Spike bentgrass	2	seed
Hordeum brachyantherum	Meadow barley	4	seed

*** No tree species to be planted below elevation 17.7 (NGVD)*

BR=bareroot
LS=live stake cuttings

Benefits of native woody plant selection include soil stabilizing root systems, plants that tolerate periodic and late season inundation from fluctuating river levels, plants that tolerate droughty condition, diversified habitat structure for wildlife and localized shade over portions of the Willamette River. Live stake plant material will provide additional anchoring of the TRM mat at toe of slope.

American Excelsior Company

EARTH SCIENCE DIVISION

December 6, 2002

Scott Clement
City of Portland

Dear Scott:

Thank you for contacting us in regards to the Creosote Remediation Project you are working on. We discussed using a combination of our Curlex II (two year) biodegradable erosion blanket with our permanent Recyclex TRM erosion blanket. By now you should have received general installation details from our Barbara Snoddy of our Customer Service Group at our Arlington, TX offices. I would like to outline the overall installation purpose of these two products as it relates to your project.

Project: Reclaimed stream bank with loose uncompacted sandy soil using live plantings installed to create a visibly pleasing vista while allowing the root system of the plantings to hold the bank together. The stream bank is approximately 2100 l. ft. long x 50-70 l. ft. high, with the bottom 15 ft subject to a local storm flood event and the top 60 ft. subject to rainfall only.

Goal: To create permanent reinforcement to specified grasses and plantings on the upper 60 ft of slope and to provide extra reinforcement for a two-year period for the lower 15 ft section that may flood.

General Installation:

- At the upstream end and the downstream end of the project trenches should be dug to at least a 3 ft. deep. At the crest (top of the slope) an anchor trench should be dug to a 2 ft depth. If constant flow is expected at the bottom of the slope, where scour is expected, care should be taken to provide protection for the bottom edge of blanket system. At the bottom of the slope (where the plantings would end) a toe trench should be dug 3 ft. deep. The purpose of these trenches would be to lock in the area of protection making an effort of keeping water from getting underneath or behind the system.

- Begin laying Curlex II over the bottom 15 ft. of the entire length of project taking care to roll the product into the upstream, downstream, toe trenches and pin down liberally. Tuck the top edge of the Curlex II into the soil approx 12 inches and pin. Abut the edges of the blanket rolls so a pin goes into the netting of both edges of blanket. This layer of Curlex II will give extra protection in case of planned flood conditions for two approximately two years.

- Begin laying the Recyclex TRM mat in the same manner over the Curlex II and the rest of the slope that is exposed taking care to also roll the product into the upstream, downstream, toe, and anchor trenches and pin down liberally. Overlap the edge of the Recyclex rolls at least three inches and pin down per installation instructions.

- After rolling blankets into all trenches and pinning, refill with soil and compact.

- If plantings are small enough to plant after the above installation, cut openings (in an x shape) in Recyclex TRM, layback and install planting. Relay blanket around planting and stake down liberally.

OFFICE: 8 OLD STAGE TRAIL – LAKE WYLIE, SC 29710
PHONE 803-831-5999: FAX 803-831-7646

- The entire area should be staked with the desired grade stakes or suitable wood stakes using approximately 1 ½ per square yard and as per stacking pattern. They should be driven down into the original compacted grade.

- Fill in the Recyclex TRM with soil from the top, working the soil into the matrix.

- Hydraulically apply the required seed mix into the soil filled matrix to add the ability to adhere the seed to the soil.

Budget Estimate:

1. Quick grass (sod green) Curlex II, two-year biodegradable erosion blanket, 8 x90, 80 SY/roll, $ 40.00/roll.

2. Recyclex TRM (using recycled green soda bottles) permanent root reinforcement system, 8 x 90, 80 SY/roll, $ 240/roll.

Disclaimer: This project recommendation is based on very basic information supplied by customer. Both the products mentioned heir in has limited hydraulic performance ratings. These ratings can be supplied if required. The system recommended is a crust (surface) treatment only and is designed to enhance and protect a grass root system and plantings until established. A qualified Engineering consultant firm should be used to diagnose any hydraulic or geotechnical issues associated with this project. Once grass and the plantings are established the system becomes an integral part of the long-term viability of the project itself.

Scott, I hope that these thoughts meet your needs. We look forward to working with you on additional details, as you require them. Please keep me posted as the project progresses, so we can work at bid time with those contractors who would have interest in installing the project.

Sincerely,

Jerry Bohannon

Jerry Bohannon
National Sales Manager, Earth Science Division
American Excelsior Co.

APPENDIX B

Essential Fish Habitat

The project area has been designated as Essential Fish Habitat (EFH) for various life stages of Chinook and coho salmon, and starry flounder (*Platyichthys stellatus*).

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California, seaward to the boundary of the U.S. exclusive economic zone (PFMC 1998a, and 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC 1999).

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Groundfish Management Plan (PFMC 1998a) and the NOAA Fisheries Essential Fish Habitat for West Coast Groundfish Appendix (Casillas et al 1998). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

EFH Considerations

The *Adverse Nonfishing Impacts and Recommended Conservation Measures* portions of the groundfish and coastal pelagic EFH appendices identify several impacts of filling projects on EFH. Those impacts include: (1) adverse effects on infaunal and bottom-dwelling organisms; (2) changes to benthic habitats resulting from erosion, slumping, or lateral displacement of surrounding bottom deposits; (3) elevated turbidity which may impact aquatic vegetation or directly affect fish species; (4) changes to the chemistry and physical characteristics of the receiving water; and (5) loss of habitat function due to burial.

Essential Fish Habitat (EFH) for the Pacific coast salmon fishery is those waters and substrate necessary for salmon production needed to support a long-term sustainable fishery and salmon contributions to a healthy ecosystem. Important features of freshwater EFH for salmon are: (1) substrate composition; (2) water quality; (3) water quantity, depth, and velocity; (4) channel gradient and stability; (5) food; (6) cover and habitat complexity; (7) space; (8) access and passage; and (9) flood plain and habitat connectivity (PFMC 1999).

Effects of Proposed Action

As described in Section 16 in the Biological Assessment Addendum, EPA determined that the project would result in degrading EFH through impacts to for water temperature, shallow water habitat, and disturbance history.

As such, EPA has determined that the proposed action may adversely affect the EFH for starry flounder and Pacific salmon species (Chinook and coho salmon).

References:

Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmidt, M. Yoklavich, A. Baily, B. Chao, B. Johnson and T. Pepperell. 1998. Essential Fish Habitat West Coast Groundfish Appendix. National Marine Fisheries Service. Seattle, WA.

Pacific Fishery Management Council (PFMC). 1998a. Final Environmental Assessment/Regulatory Review for Amendment 11 to the Pacific Coast Groundfishery Management Plan. October 1998.

Pacific Fishery Management Council. 1998b. *Essential Fish Habitat: West Coast Groundfish Appendix*. <http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html>.

Pacific Fishery Management Council (PFMC). 1999. Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon (Appendix A of Amendment 14 to the Pacific Coast Salmon Plan). <http://www.pcouncil.org/Salmon/a14efh/efhindex.html>.

APPENDIX C

Biological Requirements of Lamprey

Pacific Lamprey ***(Lampetra tridentate)***
The Pacific lamprey range from Japan and Korea to southern California and inland in the Columbia Basin to parts of the Snake River Basin (Lee et al 1980). It is an anadromous, parasitic species with the period of parasitism occurring in the ocean. Ammocoetes live in fresh water where they are burrowing filter feeders and will grow to 17 or 18 cm.

Lampreys undergoing metamorphism and spawning adults do not feed and emerge from spawning gravels at about 1 cm length. Pletcher (1963) and Kan (1975) were ambiguous about the time of metamorphism in Pacific lamprey, with nearly year-round observed occurrences. Possibly the period of metamorphism is long or it may vary regionally. Lampreys do not feed during metamorphism when extensive changes in the gut are occurring; they live on lipid reserves and may shrink in size.

Most down-stream movement by lampreys occurs at night (Potter 1980, Beamish and Levings 1991). Timing of migration may be sensitive to temperature cues. Both eyed lamprey and ammocoetes will migrate. Ammocoetes move progressively down stream, eventually accumulating in the lower parts of basins while eyed lampreys migrate to the ocean (Richards 1980, Beamish and Levings 1991).

Pacific lamprey enter salt water and parasitically attach themselves to a wide variety of fish and/or whales. They are also a prey species for marine mammals and larger fish. Once entering salt water, they move quickly offshore into waters up to 70 m deep (Beamish 1980). The length of time spent in the ocean is not known; estimates range between 6 months to 40 months (Kan 1975, Richards 1980, Beamish 1980).

Pacific lamprey are reported to return to fresh water between April and June in Canada and also along the Oregon coast (Kan 1975, Beamish 1980, Richards 1980), but are reported to enter the lower Columbia River as early as February (Kan 1975). Koskow (2002) reports that Pacific lamprey peak in numbers at Willamette Falls and at Fifteenmile Creek in May and June. Long migrations, such as up the Columbia and into the Snake, can continue as late as September.

After entering fresh water and completing part of their migration, Pacific lamprey are thought to over-winter before spawning. Bayer et al (2000) observed that adult lampreys in the John Day River, tagged upon their arrival in August, hid under boulders and were sedentary until the following March, when they moved onto spawning grounds.

Pacific lamprey do not feed after entering fresh water and persist through the winter until spawning by using lipid reserves. Over this period they may shrink up to 20% (Beamish

1980). Measurements of adult size can be variable, depending on when the sample was taken (Kan 1975, Richards 1980, Bayer et al 2000, Beamish 1980, Pletcher 1963).

In Canada, lampreys spawn in the spring between April and July (Richards 1980, Beamish 1980) while spawning occurs from March through May on the Oregon coast (Kan 1975). Koskow (2002) notes that Pacific lampreys are spawning at the same time as winter steelhead (February through May) in Oregon. Lamprey select spawning gravels just upstream of riffles and often near ammocoete habitats (silty pools and banks). They may be attracted to chemical stimuli produced by ammocoetes.

Studies of sea lamprey (*Petromyzon marinus*) in the Great Lakes have indicated that lampreys have essentially no homing behavior (Bergstedt and Seelye 1995). The adults may be attracted to concentrations of ammocoetes, detected by chemical stimuli. However, several authors have noted patterns of geographic differences in Pacific lamprey. Kan (1975) detected morphological differences between coastal and inland Columbia Basin lampreys. Both Pletcher (1963) and Beamish (1980) note "regional differences" among lamprey, which may suggest some homing behavior.

Lampreys are more species diverse in the Columbia Basin west of the Columbia Gorge. Most observations of lampreys available from this area are of ammocoetes or of lampreys undergoing metamorphism and could include a mixture of lamprey species. However, river lamprey are likely in deeper rivers such as the mainstem Columbia and Willamette where they are not encountered in the incidental surveys. It is highly likely that brook lampreys (at least *richardsoni)* are present in this area along with the Pacific Lampreys (Koskow 2002). Koskow (2002) reports that lampreys have not often been encountered by Oregon State inventory crews in the lower Columbia and Willamette, however, they are incidentally observed or captured during winter steelhead spawning surveys, and during other trapping. They have also been collected after fish kills.

The distribution of lampreys in the lower Columbia is likely reduced due to passage barriers on the Sandy and Clackamas and in the North and South Santiam, McKenzie and Middle Fork Willamette. No systematic survey of lamprey distribution has been conducted in this area nor is the historic distribution known (Koskow 2002). However, Oregon Department of Fish and Wildlife (ODFW), in a 2001 survey, found that lampreys are restricted to streams below North Fork Dam. North Fork Dam has a functional fish ladder, unlike the Willamette Basin dams on the Santiam, McKenzie, and Middle Fork. The presence of lampreys in the small direct tributaries of the lower Columbia is not known but many of these streams have small passage barriers (e.g. culverts) that may be blockages for lamprey.

Habitat

Current understanding of lampreys is not sufficient to determine all the habitat factors that influence them. However, Koskow (2002) reports that lamprey need habitats with interspersed small gravel beds (for spawning) and silt lenses (for burrowing); organic debris that will produce algae for their food; flows that are gentle to moderate; and passages they can maneuver. Beyond this basic knowledge, understanding of their needs is poor. Koskow (2002) listed the habitat issues that may pose concerns:

1) Pollution, Chemical Spills, and Other Water Quality Problems. Kan (1975) noted that western brook lampreys were present in Willamette Basin streams that were polluted by pulp mills and speculated they may be attracted to algae that may flourish near the mills due to poor water quality. Lamprey may also be able to acclimate to somewhat elevated water temperatures (van de Wetering and Ewing 1999). In Oregon, however, Koskow (2002) noted that chemical spills have resulted in fish kills, which included large lamprey kills.

Lamprey juveniles spend their lives buried in silt along stream banks and bottoms until they are ready to outmigrate. These habitats also accumulate toxins. Koskow (2002) notes that ODFW consider the Portland Harbor Superfund site in the lower Willamette as lamprey habitat and that it may support a substantial proportion of the lampreys in the Columbia Basin. While lampreys may be relatively tolerant to water pollution and sediment contamination, there is no information on the adverse effects of long-term exposure.

3) Reservoir hydrographs

Anadromous lampreys, like other anadromous fish, undergo extensive physiological changes as they migrate from fresh water to the ocean. Similar to other anadromous fish, they have a specific physiological window during which their transformation occurs. The altered hydrograph of the Columbia and Snake rivers have a significant impact on salmonids by substantially slowing their migrations during their out-migration. Lampreys are weak swimmers and juveniles in an unaltered river tend to be carried passively to the ocean during winter and spring freshets. As such, lampreys may be impacted by delayed out-migrations similarly to salmonids.

3) Dredging

Lampreys, especially the river lamprey, likely burrow in river bottom sediments throughout the available river reach all the way down to the ocean estuaries, which makes them subject to dredging impacts. Although no extensive studies have been done, Beamish and Youson (1987) found that only 3% to 26% of the lampreys passed through a dredge survived the experience.

4) Basin Scouring

Important habitat characteristics for lampreys include interspersion of small gravel beds for spawning and fine silt lenses for juvenile rearing in lower rivers where natural flows are gentler (Koskow 2002). Splash-dam logging in Oregon coastal streams resulted in extensive scouring, especially in lower basin areas. Many streams were scoured to bedrock and lamprey habitat was likely lost. This activity no longer occurs and many areas are recovering (Koskow 2002).

5) Rapid Water Draw Down

Dam operation results in periodic rapid water draw down. Lamprey ammocoetes are sensitive to changes in water pressure and light and emerge from their burrows and follow a gradual water draw down, such as what might occur after a natural flood.

However, Koskow (2002) reports that ODFW found evidence of lampreys being stranded in their burrows by rapid artificial draw down.

6) Vulnerability of High Density Areas

Preliminary observations by Koskow (2002) suggest that lampreys may concentrate at extremely high densities in particular locations. In 2001, remarkable concentrations of lampreys were found in Bear Creek in the upper Rogue Basin and Clear Creek in the lower Clackamas compared to what was observed using similar sampling methods in adjacent tributaries (Koskow 2002). No clear reason has been identified for this distribution pattern. If this is a characteristic distribution pattern for individual basins, a single catastrophic event may destroy a substantial amount of the population, even if the event affects only a small area. The extremely high kills of lampreys from a chemical spill in Fifteenmile Creek in 1999 and the John Day River in 1969 and 1982 may have occurred because the lampreys were concentrated in those specific areas.

7) Development in Floodplains and Low Gradient Reaches

Pletcher (1963) found that lampreys tended to occupy the river reaches in the lower river flood plains. In Oregon, low gradient flood plains tend to be highly developed areas with primarily industrial, urban, and agricultural development (i.e., the Willamette Valley). It is not possible to speculate about the potential impacts to lamprey caused by development and habitat alteration but it is likely to have depressed habitat availability and productivity for lampreys.

Project Area Information

The Willamette Basin is probably the most important production area for Pacific lamprey in the Columbia Basin (Koskow 2002). This was likely true historically as well as currently, as indicated by a comparison of the number of lamprey taken in the Willamette Falls fishery and the counts of adult lamprey at Bonneville Dam (Koskow 2002). The Bonneville Dam counts represent essentially the entire population of Pacific lampreys in the Columbia Basin upstream of that location. During the 1940s, the harvest at Willamette Falls was substantially more than the counts at Bonneville Dam in the same years. In the 1990s, the harvest has remained almost equal to the dam counts.

In spite of its importance as a production area and as a location of harvest, the status of Willamette Basin lampreys is poorly understood. Koskow (2002) notes that ODFW abundance trends are based on harvest records. However, Koskow (2002) states that harvest is a poor index of abundance because it is strongly influenced by regulations and harvest effort, which are not constant. ODFW records of large harvests in the 1940s occurred at a time when the harvest effort was intense. Subsequent harvest methods changed and effort declined over the years. Because of this, ODFW found that it was difficult to determine how much the change in the fishing regulations and effort influenced the differences in numbers seen in the 1940s compared to current records. However, they conclude it is highly unlikely that hundreds of thousands of adult lamprey (1940s harvests) currently pass Willamette Falls.

The scant data from the lower Columbia and Willamette indicate that lamprey abundance has declined in this area, yet ODFW identify this area as the most important production area for Pacific lampreys in the Columbia Basin.

Potential Impacts from the Proposed Action

Although the biological requirements of the salmonid species discussed in the Biological Assessment for the McCormick & Baxter Superfund Site (EPA 2002) are different than those of Pacific lamprey, all of these species benefit from similar habitat preferences. This includes relatively good water and sediment quality as well as fine-grained substrates in low energy shorelines.

As noted in the 2003 Biological Assessment Addendum (EPA 2003), the proposed actions would occur in sandy substrates that have a good likelihood of supporting Pacific lamprey. Not only would habitat be lost, there also would be a high likelihood of direct harm to ammocoetes in the substrate.

The beneficial effects of the project would be improved water and sediment quality, which would benefit lamprey in the long-term. Conservation measures at the site and in the adjacent Willamette Cove would also provide improved habitat conditions for Pacific Lamprey.

It is EPA's determination that the project **may adversely affect Pacific lamprey** due to habitat impacts and direct harm to the species.

Literature Cited

Bayer, J.M., M.H. Meeuwig, and J.G. Seelye. 2001. Identification of larval Pacific lamprey (*Lampetra tridentata*), river lamprey s (*L. ayresi*), and western brook lampreys (*L. richardsoni*) and thermal requirements of early life history stages of lampreys. Annual Report 2000. Bonneville Power Administration Project Number 2000-029. Portland, Oregon.

Beamish, R.J. 1980. Adult biology of the river lamprey (*Lampetra ayresi*) and the Pacific lamprey (*Lampetra tridentata*) from the Pacific coast of Canada. Can. J. Fish and Aquatic Sci. 37: 1906-1923.

Beamish, R.J. and J.H. Youson. 1987. Life history and abundance of young adult *Lampretra ayresi* in the Fraser River and their possible impact on salmon and herring stocks in the Strait of Georgia. Can. J. Fish and Aquatic Sci. 44: 525-537.

Beamish, R.J. and C.D. Levings. 1991. Abundance and freshwater migrations of the anadromous parasitic lamprey, *Lampetra tridentata*, in a tributary of the Fraser River, British Columbia. Can. J. Fish and Aquatic Sci. 48: 1250-1263.

Bergstedt, R.A. and J.G. Seelye. 1995. Evidence for lack of homing by sea lampreys. Transactions of the American Fisheries Society. 124:235-239.

Environmental Protection Agency (EPA). 2002. Biological Assessment, McCormick and Baxter Creosoting Company, Portland, Oregon. June 2002

Environmental Protection Agnecy (EPA). 2003. DRAFT Addendum to the Biological Assessment. Sediment Cap. McCormick and Baxter Creosoting Company, Portland, Oregon. March 2003.

Kan, T.T. 1975. Systematics, Variation, Distribution and Biology of Lamprey s of the genus *Lampetra* in Oregon. Dissertation for the Doctor of Philosophy, Oregon State University, Corvallis, Oregon.

Koskow, K. 2002. Oregon Lampreys: Natural History Status And Analysis of Management Issues. Oregon Department of Fish and Wildlife. February 25, 2002

Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer. 1980. Atlas of North American Freshwater Fishes. Publication #1980-12, Northern Carolina Biological Survey. pp.24-34.

Pletcher, F.T. 1963. The Life History and Distribution of Lamprey s in the Salmon and Certain Other Rivers in British Columbia, Canada. Master of Science Thesis. University of British Columbia, Vancouver B.C. 195 p.

Potter, I.C. 1980. Ecology of larval and metamorphosing lampreys. Can. J. Fish. Aquat. Sci. 37:1641-1657.

Richards, J.E. 1980. Freshwater biology of the anadromous Pacific lamprey *Lampetra tridentata*. Master of Science, University of Guelph, Ontario, Canada. 99p.

van der Wetering, S.J. and R. Ewing. 1999. Lethal Temperatures for Larval Pacific Lamprey, *Lampetra tridentata.* Confederated Tribes of the Siletz Indians, Siletz Oregon.